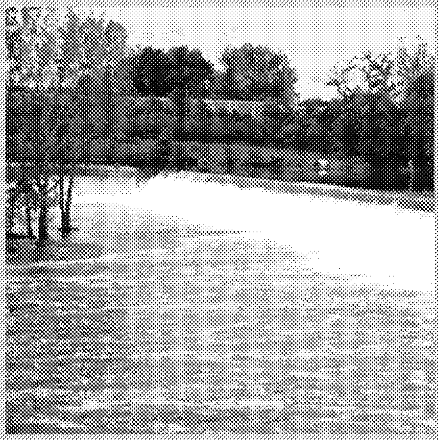
Quality Assurance Project Plan
Lower Passaic River Restoration Project
Quality Assurance Project Plan/Field Sampling Plan Addendum
RI Water Column Monitoring/Small Volume Chemical Data Collection

Revision 1, July 2011



Prepared for:
Cooperating Parties Group
Newark, New Jersey

Document No.: 60145884.A554

Quality Assurance Project Plan/Field Sampling Plan Addendum

Remedial Investigation Water Column Monitoring/Small Volume Chemical Data Collection

Lower Passaic River Restoration Project

July 2011

Revision 1

Contents

List of Acronyms

Acronym	Definition
%D	Percent Deviation
ADCP	Acoustic Doppler Current Profiler
ARAR	Applicable, Relevant or Appropriate Requirements
BCS_3	Batch Control Spike
BFB	Bromofluorobenzene
BOD	Biological Oxygen Demand
Br	Bromine
C	Celsius
CA	Corrective Action
CARP	Contaminant Assessment Reduction Program
CAS Number	Chemical Abstract Services Number
CAS	Columbia Analytical Services
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic Feet per Second
CFT	Chemical Fate and Transport
CFU	Colony Forming Unit
Cl	Chlorine
COC	Chain-of-Custody
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CPG	Cooperating Parties Group
CPR	Cardiopulmonary Resuscitation
CRM	Certified Reference Material
CSM	Conceptual Site Model
CSO	Combined Sewer Overflow
Cu	Copper
CVAFS	Cold Vapor Atomic Fluorescence
CWCM	Chemical Water Column Monitoring
ddms	de maximis Data Management Solutions, Inc.
DFTPP	Decafluorotriphenylphosphine
dGPS	Differential Global Positioning System
DMP	Data Management Plan
DOC	Dissolved Organic Carbon
DOT	Department of Transportation
DQI	Data Quality Indicators
DQO	Data Quality Objective

List of Acronyms (Continued)

Acronym	Definition
DUO	Data Use Objective
DVR	Data Validation Report
E. Coli	*Escherichia coli*
ECD	Electron Capture Detector
EDD	Electronic Data Deliverable
EDP	Electronic Data Processor
EHS	Environmental Health and Safety
EMBM	Empirical Mass Balance Model
EDL	Estimated Detection Limit
EML	Estimated Minimum Level
EMSL	Environmental Molecular Sciences Laboratory
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FID	Flame Ionization Detector
FPD	Flame Photoionization Detector
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Foot (Feet)
FTM	Field Team Manager
FWM	Food Web Model
GC	Gas Chromatography
GC/MS	Gas Chromatography-Mass Spectrometry
GEL	General Engineering Laboratories
GPC	Gel Permeation Cleanup
GPS	Global Positioning System
H_2SO_4	Sulfuric Acid
HASP	Health and Safety Plan
HAZMAT	Hazardous Materials
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	Hydrochloric acid
HHRA	Human Health Risk Assessment
HOC	Hydrophobic Organic Constituents
HPLC	High Pressure Liquid Chromatography
HRGC	High Resolution Gas Chromatography
HRMS	High Resolution Mass Spectrometry
HSL	Hazardous Substances List
HSMVS	HOC Sampling Method Validation Study

List of Acronyms (Continued)

Acronym	Definition
IC	Ion Chromatography
ICAL	Initial Calibration
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICP/AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV	Initial Calibration Verification
IDW	Investigation-Derived Wastes
IEC	Inter Element Corrections
IPR	Internal Precision and Recovery
K&L Gates	Kirkpatrick and Lockhart Preston Gates Ellis LLP
L	Liter
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LFB	Laboratory Fortified Blank
LIMS	Laboratory Information Management System
LOC	Level of Chlorination
LPR	Lower Passaic River
LPRRP	Lower Passaic River Restoration Project
LPRSA	Lower Passaic River Study Area
LRMS	Low Resolution Mass Spectrometry
M	Molar
MB	Method Blank
MDL	Method Detection Limit
MEDD	Multi-media Electronic Data Deliverable
mg/L	Milligrams per Liter
min	Minute
mL	Milliliter
ML	Minimum Level
Mn	Manganese
mo	Month
MPI	Malcolm Pirnie, Inc.
mS/cm	Micro Siemens per centimeter
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NaOH	Sodium Hydroxide
NB	Newark Bay
NBSA	Newark Bay Study Area

List of Acronyms (Continued)

Acronym	Definition
ng/L	Nanograms per Liter
ND	Not Detected
NH3	Ammonia
NIST	National Institute of Standards and Technology
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
NS	No Standard
NY	New York
NY/NJ HEP	New York-New Jersey Harbor Estuary Program
OC	Organochlorine
OPR	On-going Precision and Recovery
OSI	Ocean Surveys, Inc.
OU	Operable Unit
P&T	Purge and Trap
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Project Action Limit
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzo-p-dioxin
PCDF	Polychlorinated Dibenzofuran
PE	Performance Evaluation
PFD	Problem Formulation Document
PFK	Perfluorokerosene
pH	Potential Hydrogen
PID	Photoionization Detector
PM	Project Manager
POC	Particulate Organic Carbon
ppth	Part per Thousand
PQO	Project Quality Objectives
PREmis	Passaic River Estuary Management Information System
PRP	Potentially Responsible Party
PTFE	Polytetrafluoroethylene
PT/PE	Performance Testing/ Performance Evaluation
PWCM	Physical Water Column Monitoring
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCCS	Quality Control Check Sample

List of Acronyms (Continued)

Acronym	**Definition**
QL	Quantitation Limit
QMP	Quality Management Plan
RA	Risk Assessment
RCL	Recovery Control Limits
RF	Response Factors
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RM	River Mile
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factors
RSD	Relative Standard Deviation
S&A	Sampling and Analytical
S/N	Signal to Noise
SAIC	Science Applications International Corporation
SDG	Sample Delivery Group
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	System Performance Check Compounds
SRM	Standard Reference Materials
SSC	Suspended Solids Concentration
SSO	Site Safety Officer
SVCG	Small Volume Composite Grab
SVOC	Semi-Volatile Organic Compound
SWO	Stormwater Outfall
TAL	Target Analyte List
TC	Technical Committee
TCL	Target Compound List
TDS	Total Dissolved Solids
TIC	Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TSA	Technical Surveillance Audit
VER	Calibration Verification

List of Acronyms (Continued)

Acronym	Definition
VOA	Volatile Organics Analysis
VOC	Volatile Organic Compound
UCL	Upper Confidence Limit
ug/L	Microgram per Liter
UFP	Uniform Federal Policy
um	Micron
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Service
UV-VIS	Ultraviolet-Visible Spectrophotometry
v/v	Volume to Volume
WCM	Water Column Monitoring

Introduction

This Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) Addendum detail the proposed execution of a portion of the Water Column Monitoring (WCM) Program of the Remedial Investigation (RI) as outlined in the Lower Passaic River Restoration Project (LPRRP) FSP, Volume 1 (Malcolm Pirnie, Inc. (MPI) 2006). The RI is required by the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (RI/FS) (Settlement Agreement [USEPA 2007a] and its Appendix B (i.e., Statement of Work [SOW]). The Cooperating Parties Group (CPG), which included 73 Potentially Responsible Parties (PRPs), has entered into the Settlement Agreement (USEPA 2007a) to perform the RI. This document uses applicable worksheets from the United States Environmental Protection Agency (USEPA) Uniform Federal Policy (UFP) on QAPPs [Publication Numbers: EPA: EPA-505-B-04-900A DoD: DTIC ADA 427785] (USEPA 2005). This document includes both the QAPP and the FSP Addendum, which is included as Appendix A. Appendix B contains the field standard operating procedures (SOPs) and Appendix C contains the laboratory SOPs.

The WCM program has been divided into two subtasks. One subtask, the WCM/Physical Data Collection or Physical WCM (PWCM) program, includes collection of physical measurements in the water column (currents, temperature, conductivity, turbidity, organic carbon and solids). This subtask has been performed under the *Quality Assurance Project Plan/Field Sampling Plan Addendum, Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring, Lower Passaic River Restoration Project* (AECOM 2010a). The other subtask, WCM/Chemical Data Collection or Chemical Water Column Monitoring (CWCM), a portion of which is addressed in this QAPP, includes collection of water column samples for chemical analysis. The portion of the CWCM data collection described in this QAPP covers the small volume sampling phase of the subtask; a high volume sampling phase is currently being planned and will be proposed as a separate QAPP/FSP Addendum. The information collected with respect to the physical characteristics of the Lower Passaic River (LPR) has been used to aid in the development of the FSP for this phase of the CWCM program.

The proposed investigation includes the collection of small volumes of water (i.e., consistent with SW-846 and other federal and state methods) for analysis of the target analytes in whole water, with a subset of metals and organic carbon analyzed in the dissolved phase. All proposed analyses have been assigned to one of four groups described in the following paragraphs:

Group A - A list of target physical, and inorganic and organic chemical analyses is proposed for the full set of events, stations and depths (refer to Worksheet #15). These analytes will be measured in all samples during each of the eight events and will be used primarily for estimation of exposure point concentrations (EPCs) for the human health risk assessment (HHRA), ecological risk assessment (ERA) and food web model (FWM), and in the calibration of the chemical fate and transport (CFT) model. This analyte list is consistent with the Modeling Work Plan (HydroQual, 2006) and includes polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/PCDFs), polychlorinated biphenyl (PCB) congeners and homologs, and mercury (total and dissolved). Total and dissolved cadmium, copper and lead will also be included in the Group A list. Supporting parameters to be used in the CFT model (i.e., dissolved organic carbon (DOC), particulate organic carbon (POC), suspended solids concentration (SSC), total organic carbon (TOC), chlorophyll a, alkalinity, sulfate, total sulfide, total dissolved solids (TDS), and chloride) are also included.

Group B - A comprehensive list of physical, and inorganic and organic chemical analyses is proposed for the full set of stations and depths for a subset of sampling events (refer to Worksheet #15). These parameters will be used to support EPC calculations for the HHRA, ERA and FWM, as well as validation of the CFT model, and include target compound list (TCL) semivolatile organic compounds (SVOCs), TCL volatile organic compounds (VOCs), target analyte list (TAL) metals, a subset of TAL metals in dissolved phase (arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc), titanium, methyl mercury (total and dissolved), hexavalent chromium (dissolved only), butyltins, organochlorine (OC) pesticides, cyanide, polycyclic aromatic hydrocarbons (PAHs), alkyl PAHs, hardness (calculated), total Kjeldahl nitrogen (TKN), ammonia and total phosphorus. Tentatively identified compounds (TICs) will be reported in association with the TCL VOC and SVOC analyses.

Group C - Pathogen analyses are proposed for near-surface samples from five stations in RM 0 - 17.4 of the LPR to determine their relevance in future investigation phases. The five stations, shown in Worksheet #18, were selected by reviewing the sample maps to ensure coverage within the full length of the river, with a focus on areas where combined sewer overflows (CSOs) are present and to provide information regarding the input of pathogens during storm events from off-site sources. Group C will be sampled during spring and summer routine events, the low flow/spring tide event, and both high flow events and includes total coliform and *Escherichia coli* (*E. coli*), fecal coliform, fecal streptococci and fecal enterococci bacteria. Analysis of Group C parameters will be conducted outside the RI/FS Trust for the LPRSA.

Group D - Additional pathogen analyses are proposed for near-surface samples from the five stations in the LPR (RM 0 - 17.4) to determine their relevance in future investigation phases. Group D includes the protozoans *Giardia* and cryptosporidium, and will be sampled during summer routine events and both high flow events. Analysis of Group D parameters will be conducted outside the RI/FS Trust for the LPRSA.

Specific stations designated for the additional Group C and D analyses are identified in Worksheet #18.

The collection of these water samples occur over the course of eight planned sampling events. The events are described below and summarized in Table 1. The flow thresholds for the low flow and high flow events were selected from an analysis of the discharge record at Dundee Dam (April 2007 to August 2010). The low flow event threshold was identified by conducting an analysis of the number of events satisfying both the discharge criterion and the spring-tide criterion. The analysis showed that a discharge criterion of <400 cubic feet per second (cfs) was satisfied multiple times (i.e., 8-12 times per calendar years 2007-2009) in each of the years over the period of record at Dundee Dam.

The high flow threshold was identified by conducting a return frequency analysis using the available discharge data at Dundee Dam. A flow event with a return period of 3 months (or 4 occurrences per year) was chosen as the flow threshold that can reasonably be expected to be exceeded during the CWCM period. Accordingly, the discharge associated with the 1 in 3 months event at Dundee Dam was calculated to be 3,000 cfs and is proposed as the minimum flow for a high flow event.

- **Routine Events** – Five Routine Events are planned over the course of approximately one year under normal flow conditions (400 - 3,000 cfs at the gage at Dundee Dam). The five events are planned to occur in winter (one event), spring (two events) and summer (two events). At least one Routine Event will occur under spring tide conditions and one under neap tide conditions. The sample locations will include the Lower Passaic River Study Area (LPRSA) (the lower 17.4 miles of the Passaic River and its tributaries), above Dundee Dam, and the Newark Bay Study Area (NBSA), which is defined as including Newark Bay and its confluences with the Hackensack River, Arthur Kill and Kill van Kull (Worksheet #18). The data collected during the Routine Events will support the exposure point calculations for the risk assessments (RAs) and FWM. The Routine Events are planned to occur under several different flows, ranging from 400 - 3,000 cfs at Dundee Dam. These events are designed to provide information regarding the variability of chemical concentrations in the study area to support the calibration and validation of the CFT model. It is anticipated that the Routine Events will capture data representative of the normal influxes and mixing processes in the river and the bay, the deposition of particulates from the water column to the sediment, and of the preliminary diffusive flux of contaminants from the sediments to the water column. One hundred (100) samples will be collected during each of the Routine Events to be analyzed for target analytes as defined in Worksheet #15. Group A analytes will be sampled in each event. Group B analytes will be measured in one spring and two summer events. Shallow (3 feet (ft) below surface) water stations in the five locations in the lower 17.4 miles of the LPR will be analyzed for pathogens (Groups C and D - Worksheet #15 and #18). Group C analytes (coliform bacteria) will be analyzed in the two spring and two summer events; and Group D analytes (Giardia and cryptosporidium) will be sampled during the summer events. Frequency and type of QC samples are provided in Worksheet #20.

- **High Flow Events** – Two High Flow Events are planned under storm-induced high flow (i.e., not sustained high flow) conditions (>3,000 cfs at Dundee Dam). The planned sample locations include the LPRSA, above Dundee Dam, and NBSA (Worksheet #18). The data collected during the High Flow Events will be used to support the exposure point calculations for the RAs and FWM. The data will also be used to support the preliminary calibration and validation of the CFT model (e.g., the resuspended flux from the sediments to the water column, and the subsequent deposition of particle-bound contaminants from the water column to the sediment). It is also anticipated that during these events there will be a higher loading of suspended sediments (i.e., more contamination on a per unit weight suspended solids basis may occur since elevated flows associated with storm events will resuspend more bed sediment). These data will be used in conjunction with CSO and storm water outfall (SWO) data being collected by Tierra Solutions, Inc. (Tierra Solutions, Inc. 2011) to estimate loading using the Passaic Valley Sewer Commissioner's Storm Water Management Model (SWMM) or empirical loading calculations, and for contaminant source identification. The CSO and SWO data to be collected by Tierra are being analyzed using analytical techniques, described in the CSO/SWO QAPP (Tierra Solutions, Inc. 2011), that are different from those being implemented in the small volume CWCM QAPP and may include larger volumes of water for some analytes. However, differences in the analytical method will not negate the usefulness of combining these data. The SWMM will be used to calibrate and validate the external inputs to the system in the CFT model. One hundred six (106) samples will be collected during each of the High Flow Events to be analyzed for target analytes as defined in Worksheet #15. Group A analytes will be measured during both events. Group B analytes will be measured in one of the two events. Shallow (3 ft below surface) water stations in the five locations in the LPR (RM 0 – 17.4) will be analyzed for pathogens (Worksheet #15 and #18). Group C analytes (coliform bacteria) and Group D analytes (*Giardia* and cryptosporidium) will be sampled during both events. Frequency and type of QC samples are provided in Worksheet #20.
- **Low Flow/Spring Tide Event** – One event is planned under low flow conditions (<400 cfs at Dundee Dam) during a spring tide in order to capture data representative of periods with greatest tidal mixing. With this discharge, the salt wedge is upstream of the Primary Erosion Zone identified by USEPA (MPI 2007a). The sample locations will include the stations in the LPRSA and above Dundee Dam (Worksheet #18). The data collected during the Low Flow/Spring Tide Event will provide additional data in the lower reaches of the river to support the exposure point calculations for the risk assessments and FWM. This event is proposed to include combining low-flow conditions (< 400 cfs at Dundee Dam) with a spring tide in order to measure chemical transport when the highest tidal energies and tidal mixing may be occurring in the LPRSA; these data will be used to support the calibration and validation of the

CFT model. Forty-four (44) samples will be collected during the Low Flow/Spring Tide Event to be analyzed for Group A and Group B target analytes as defined in Worksheet #15. Shallow (3 ft below surface) water stations in the five locations in the LPR (RM 0 – 17.4) will be analyzed for Group C analytes (coliform bacteria) (Worksheet #15 and #18). Group D analytes (*Giardia* and cryptosporidium) will not be sampled during the Low Flow/Spring Tide Event. Frequency and type of QC samples are provided in Worksheet #20.

The water column chemical and physical data collection activities are important components of the LPRSA RI/FS and the NBSA RI/FS, which include characterizing the fate and transport of contaminants within the river, assessing risks to human health and ecological receptors, calibration and validation of the LPRSA/NBSA CFT model, and assessing the feasibility of remedial alternatives.

During the first Routine Event, a subset of twenty (20) samples will be sent to the laboratory for rapid analysis and turnaround of Group A parameters. The samples will be used to test the low-end sensitivity of the small volume analytical methods. Specifically, these samples will be collected from the following stations:

- RM10.2/13.5 at Low Slack (3 ft below surface) and Max Flood (3 ft below surface)
- RM 1.4 at Max Flood (3 ft below surface) and High Slack (3 ft below surface)
- RM 6.7/Tidal 2 at Max Ebb (3 ft below surface) and Low Slack (3 ft below surface)
- Newark Bay Northeast at High Slack (3 ft below surface) and Max Flood (3 ft below surface)
- Newark Bay South at High Slack (3 ft below surface) and Max Flood (3 ft below surface)
- Second River
- Third River
- Saddle River
- Above Dundee Dam
- Hackensack River at High Slack (3 ft below surface) and Max Ebb (3 ft below surface)
- Arthur Kill at Max Flood (3 ft below surface) and Low Slack (3 ft below surface)
- Kill van Kull at Max Flood (3 ft below surface) and Low Slack (3 ft below surface)

Upon receipt of the data from the laboratory, USEPA, CPG and Tierra will review the data to determine the efficacy of the small volume methods to achieve the Project Quality Objectives (PQOs). The CPG and Tierra will provide opinion to USEPA, who will make the final determination. No additional sampling will occur until an agreement is reached on the results of the first event Group A sample analyses and their implications for ongoing sampling and analysis methods.

Table [SEQ Table * ARABIC] CWCM Small Volume Sampling Program

Sampling Event Type	Dundee Dam Flow (cfs)	Frequency	Location	Season/ Frequency	Analyte Groups			
					A	B	C	D
Routine Events	400 – 3,000	5[a]	LPRSA Above Dundee Dam NBSA	One in Winter Two in Spring Two in Summer	All 8 Events	One in Spring[b] Two in Summer	Two in Spring Two in Summer	Two in Summer
High Flow Events	> 3,000	2	LPRSA Above Dundee Dam NBSA	As encountered		One event[c]	Both events	Both events
Low Flow/ Spring Tide Event	< 400	1	LPRSA Above Dundee Dam	One in late Summer/early Fall		One event	One event	Not sampled

Notes:

a – At least one Routine Event will be sampled under spring tide conditions and one under neap tide conditions.

b – Group B data are being collected to support the RI, risk assessment and model validation. Data from all events are not necessary to support these efforts. Therefore, Group B data will be collected during the periods of maximum potential exposures and biological activity (i.e., summer and spring) rather than in winter.

c – Adequate Group B data will be obtained from one High Flow Event to validate the model.

Locations:

LPRSA includes:
- Saddle River
- Second River
- Third River
- LPR RM 10.2 (when flows are > 250 cfs) or LPR RM 13.5 (when flows are < 250 cfs)
- LPR RM 0
- LPR RM 1.4
- LPR RM 4.2 (when flows are > 1,000 cfs) or LPR halfway between the toe of the salt wedge and RM 1.4 up to RM 4.2 (when flows are < 1,000 cfs)
- LPR RM 6.7 (when flows are < 1,000 cfs) or LPR approximately one mile downstream of the toe of the salt wedge (when flows are < 1,000 cfs)

NBSA includes:
- Newark Bay East
- Newark Bay Northeast
- Newark Bay Northwest
- Newark Bay South
- Kill van Kull
- Arthur Kill
- Hackensack River

Analyte Groups:

Group A - PCDD/PCDFs, PCB congeners and homologs, mercury (total and dissolved), cadmium (total and dissolved), copper (total and dissolved), lead (total and dissolved), DOC, POC, SSC, TOC, chlorophyll a, alkalinity, sulfate, total sulfide, TDS, and chloride.

Group B - TCL SVOCs, TCL VOCs, TAL metals, a subset of TAL metals in dissolved phase (arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc), titanium, methyl mercury (total and dissolved), hexavalent chromium (dissolved only), butyltins, OC pesticides, cyanide, PAHs, alkyl PAHs, hardness (calculated), TKN, ammonia and total phosphorus.

Group C - total coliform and *E. coli*, fecal coliform, fecal streptococci and fecal enterococci bacteria. Group C will only be sampled from the near surface depth at LPR stations between RM 0 and 17.4.

Group D - protozoans *Giardia* and cryptosporidium. Group D will only be sampled from the near surface depth at LPR stations between RM 0 and 17.4.

Environmental History and Setting

The LPRSA and NBSA have been highly modified to accommodate urbanization, including the development of residential areas and industrial activities. Changes in the LPR, Newark Bay (NB), and the associated watershed that accompanied European settlement and industrialization of the area to the present day are well chronicled (Iannuzzi et al. 2002). Most of the tidal marsh, mudflats, shallow nearshore areas, and tidal wetlands historically present in the LPRSA and NBSA have been either filled or dredged. Today, the majority of the shoreline in the LPR consists of riprap and sheet pile walls resulting in a highly channelized river. Upper portions of the LPR feature generally steeper and less modified shorelines with limited areas of riparian vegetation.

History of the LPR and Newark Bay

More than 200 years of industrialization and urbanization have had a substantial effect on the LPR watershed and NB, which were an important location for industry during the American Industrial Revolution (MPI 2007b). These early industries, as well as other industries that developed during the19th and early 20th centuries, used the LPR and NB for process water and waste disposal, which adversely affected water and sediment quality (Iannuzzi and Ludwig 2004). In addition, overall sediment and water quality is impaired as a result of historical direct municipal discharges, historical and continuing surface runoff, and municipal CSOs and SWOs. These impacts to general water quality were reduced in 1970 when the Clean Water Act was passed (Iannuzzi and Ludwig 2004).

In 1858, the Dundee Dam and associated locks were constructed on the LPR. After the completion of the dam, mills were built along the upper LPR near the City of Passaic [ADDIN EN.CITE <EndNote><Cite><Author>Iannuzzi</Author><Year>2002</Year><RecNum>11660</RecNum><record><rec-number>11660</rec-number><ref-type name="Book">6</ref-type><contributors><authors><author>Iannuzzi, T J</author><author>Ludwig, D F</author><author>Kinnell, J C</author><author>Wallin, J M</author><author>Desvousges, W H</author><author>Dunford, R W</author></authors></contributors><titles><title>A common tragedy: history of an urban river</title><short-title>zzz</short-title></titles><dates><year>2002</year></dates><pub-location>Amherst, MA</pub-location><publisher>Amherst Scientific Publishers</publisher><call-num>TX-0066</call-num><label>Passaic</label><urls></urls></record></Cite></EndNote>] Above Dundee Dam, the City of Paterson was a significant center of industrialization and manufacturing beginning in the late 18th Century. In the early 20th Century, Newark, New Jersey, became one of the largest industrial cities in the United States. Industries included petroleum refineries, shipping facilities, tanneries, and various manufacturers [ADDIN EN.CITE <EndNote><Cite><Author>Battelle</Author><Year>2005</Year><RecNum>10889</RecNum><record><rec-number>10889</rec-number><ref-type name="Report">27</ref-type><contributors><authors><author>Battelle</author></authors></contributors><titles><title>Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers</title></titles><dates><year>2005</year></dates><pub-location>Duxbury, MA</pub-location><publisher>Battelle</publisher><call-num>Projects\06-58-01 Passaic RI\Documents\Risk assessment\Pathways Analysis Report\$2005-07-27 Passaic PAR-Battelle.pdf</call-num><label>Passaic</label><urls></urls></record></Cite></EndNote>].

Approximately 88 percent of the wetlands near the LPR and Newark Bay were lost after 1816 (Iannuzzi et al. 2002). These wetland areas were ditched, diked, drained, and covered with fill material for various purposes including: salt hay production, gardens and dairies, railroad beds, oil storage/refining, shipyards and shipping ports, mosquito control, municipal and industrial waste disposal, and airport development (Iannuzzi et al. 2002). Dredging in the LPR began in 1874 and continued until 1983, but only maintenance dredging occurred after 1940 [ADDIN EN.CITE <EndNote><Cite><Author>Iannuzzi</Author><Year>2004</Year><RecNum>10900</RecNum><record><rec-number>10900</rec-number><ref-type name="Journal Article">17</ref-type><contributors><authors><author>Iannuzzi, T J</author><author>Ludwig, D F</author></authors></contributors><titles><title>Historical and current ecology of the Lower Passaic River</title><secondary-title>Urb Habit</secondary-title><short-title>Ludwig, D F</short-title></titles><periodical><full-title>Urb Habit</full-title></periodical><pages>3-30</pages><volume>2</volume><number>1</number><dates><year>2004</year></dates><call-num>Projects\06-58-01 Passaic RI\Documents\Habitat and ecology\$Iannuzzi and Ludwig 2004.pdf</call-num><label>Passaic</label><urls></urls></record></Cite><Cite><Author>Malcolm Pirnie</Author><Year>2007</Year><RecNum>11274</RecNum><record><rec-number>11274</rec-number><ref-type name="Report">27</ref-type><contributors><authors><author>Malcolm Pirnie,</author></authors></contributors><titles><title>Lower Passaic River Restoration Project: Draft source control early action focused feasibility study. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation</title></titles><dates><year>2007</year></dates><pub-location>White Plains, NY</pub-location><publisher>Malcolm Pirnie, Inc.</publisher><call-num>Projects\06-58-01 Passaic RI\Documents\Focused Feasibility Study ($M-P 2007)</call-num><label>Passaic</label><urls></urls></record></Cite></EndNote>]. The dredging allowed for commercial shipping and for deeper-draft ships to dock in the lower section of the LPR. In NB, dredging began in 1860, and between 1891 and 1934, a series of federal navigation channels and the large marine terminal at Port Newark were constructed. The dredge materials were used as fill at Port Newark and along the eastern shoreline to facilitate shoreline development. Maintenance dredging began in 1934 and continues to present day within NB and its tributaries. The latest dredging project, the New York/New Jersey Harbor Deepening Project, includes dredging in Ambrose Channel, Anchorage Channel, Kill van Kull Channel, Newark Bay Channels, the Port Jersey Channel, Arthur Kill (to Howland Hook), and Bay Ridge Channel to 50 feet deep in order to allow safe passage of new large container ships. Of these, Newark Bay Channel, Arthur Kill Channel, and Kill van Kull Channel are within the study area for the CWCM program. In addition to the Harbor Deepening Project, navigation channels throughout NB and the LPR are subject to maintenance dredging that may occur periodically, and is dependent on the rate of sediment accumulation.

The LPRSA is an operable unit of the Diamond Alkali Superfund Site. The NBSA, having been impacted by historical releases of PCDD/Fs and other contaminants due to tidal mixing, is also an operable unit of the Diamond Alkali Superfund Site. In 1984, the Diamond Alkali Superfund Site was placed on the National Priorities List as a result of past industrial operations at the Diamond Alkali plant (80-120 Lister Avenue in Newark, New Jersey), which resulted in the release of hazardous substances such as PCDDs and pesticides. Sampling of Passaic River sediments conducted during the RI/FS for the Diamond Alkali plant revealed numerous organic and inorganic compounds including, but not limited to, PCDD/PCDFs, pesticides, PCBs, PAHs, and metals. In 1994, an investigation of a 6-mile stretch of the Passaic River centered on the Diamond Alkali plant was begun. Extensive sampling showed that the sediments throughout the 6-mile study area were contaminated with organic and inorganic substances. In 2001, USEPA expanded the scope of the Superfund study to encompass the 17.4-mile stretch of the Passaic

River and added a large number of PRPs for historical releases that potentially contributed to the chemicals found in the river.

Physical Setting of the LPRSA and NBSA

The LPRSA can be characterized as a stratified estuary. It receives inflows of marine (salt) water from Newark Bay and freshwater from the upper Passaic River (above Dundee Dam) and from the tributaries and the CSO/SWOs located below Dundee Dam. The less dense freshwater flows downstream over the tidally influenced salt water that, on the flood tide, moves upstream from Newark Bay. The current Conceptual Site Model (CSM) (MPI 2007b) defines the LPRSA based on three salinity regimes specified by river mile (RM):

- Freshwater River Section (RM 10–17.4) is the region usually upstream of the salt front (the salt front rarely extends further upstream than RM 13 and is upstream of RM 10 typically about 10% of the time).
- Transitional River Section (RM 6–10) is characterized by the most frequent location of the salt front with water conditions varying from slightly brackish (or oligohaline, with salinity values ranging from 0.5 parts per thousand [ppth] to 5 ppth) to moderately brackish (or mesohaline, with salinity values ranging from 5 ppth to 18 ppth).
- Brackish River Section (RM 0–6) is located downstream of the typical location of the salt front and is mesohaline, i.e., with salinity values ranging from 5 ppth to 18 ppth.

The location of the salt wedge (i.e., a wedge-shaped intrusion of salt water into the estuary that slopes downward in the upstream direction) is dependent on the phase of the tide and the volume of freshwater flowing downstream. In general, the salt wedge extends further upstream during spring flood tides and low river flow, although the leading edge of the wedge is pushed further downstream during high river flow events, and may intrude into Newark Bay during storm events with very high freshwater flows. Salinity measured near RM 10 was shown to have a maximum salinity between 3 and 6 ppth during the summer of 2005 (MPI 2007b), whereas preliminary data collected as part of the PWCM program indicate the salinity at RM 10.2 is generally less than 2 ppth under non-low flow conditions. The extent of the salt wedge is currently being characterized by data obtained during the PWCM program in conjunction with the hydrodynamic model.

The LPR is relatively shallow, with maximum thalweg (i.e., deepest point, laterally, across the river) depths ranging from a few feet (upper portions below Dundee Dam) to 30 feet near the mouth of the river. A federally authorized navigation channel exists between the mouth of the river and approximately RM 15.4 (United States Army Corps of Engineers [USACE] 2007). Surficial sediment grain size in the main stem of the LPRSA gradually transitions from coarse material (gravel or rock) typically occurring in the upstream reach to fine material (silts and fine sand) occurring near the mouth (MPI et al. 2006, AECOM 2010a). Some deviations from this trend are found in lower areas of the LPRSA where steepened shorelines have been armored, in erosional areas associated with bridge abutments, and near river bends.

NB is approximately one mile wide and six miles long. According to USACE (1997), NB is naturally a shallow water body, with navigation channels, turning basins and docking facilities encompassing the deepest areas of the bay. The eastern side of the bay is very shallow, with depths ranging from 0.5 to 10 feet below mean low water. Areas south of Kearny Point and the Elizabeth Channel and along the western side of the bay above and below Port Newark Channel include other smaller pockets of shallow water.

The Passaic and Hackensack Rivers flow into NB from the north. NOAA (1984) estimates an annual average of 1,448 cubic feet per second (cfs) of freshwater discharges to NB from the LPR making it the largest contributor of freshwater NB; an additional 194 cfs of freshwater enters from the Hackensack River. On the south side of NB, Arthur Kill and Kill van Kull exchange saltwater with NB during tidal cycles. Suszkowski (1978) developed a sediment and water budget for NB that indicated the Kill van Kull is the largest contributor of inorganic sediments to NB; combined with Arthur Kill, the exchange provides 64% of inorganic sediments. The LPR and Hackensack River contribute approximately 31% of inorganic sediments.

PWCM Data Collection Subtask

The PWCM subtask was performed during two deployments: October – December 2009 (2009 fall deployment) and March - July 2010 (2010 spring/summer deployment). Data were collected to characterize currents and flows, temperature, salinity, and solids in the water column within the LPRSA during 2009 fall deployment, and both the LPRSA and NBSA during the 2010 spring/summer deployment. A detailed description of the field activities can be found in the PWCM QAPP and FSP Addendum (AECOM 2010a). These data have been provided to the USEPA and are currently undergoing review and analysis by the USEPA and CPG Modeling Teams.

The interaction between freshwater and estuarine tidal flows within the LPRSA impacts the fate and transport of sediment and contaminants. High freshwater flows have the potential to wash sediments into the LPR from above Dundee Dam, CSOs, SWOs and the LPRSA tributaries, resuspend the sediments, and transport sediments and constituents bound to those sediments out of the LPRSA and into the NBSA. The magnitude of tidal flows during a high freshwater flow event will impact channel velocities and transport of sediments. During low flow events on a flood tide, it may be possible for tidal action to move contaminated sediments into the LPR from Newark Bay. Flood tidal velocities that exceed ebb tidal velocities can result in net upstream transport during extended periods of low freshwater flows.

Data on the physical characteristics of the LPR have been collected by Tierra Solutions, Inc., Rutgers University for New Jersey Department of Transportation (NJDOT), and MPI for the USEPA. The primary physical and chemical water column data sets collected during the past 15 years in the LPRSA were reviewed to establish data quality and usability. Attachment 1 of the PWCM QAPP (AECOM 2010a) provides a review of these historic data sets, some examples of the data, a review of data quality, and a summary of their collective ability to address the Data Quality Objectives (DQOs) of the study. These data sets, combined with the data collected by the CPG, were used to feed the sampling design of the program defined in this QAPP.

The PWCM data were reviewed. These data, including the location of the salt water wedge under different flow regimes, and the relative and estimated suspended solids concentrations on a temporal and spatial basis, were used to develop the sampling plan. In addition to data that can be used in the risk assessments and food web model, the number, locations, and timing of samples in the small volume CWCM program are intended to provide data to support the calibration, validation, and sensitivity testing of the CFT model. The study design of the CWCM small volume program will provide the CFT model with data from a variety of flow conditions, including extreme low or high flows.

CWCM Data Collection Subtask

Limited surface water chemical concentration data from the LPRSA have also been collected, but these data are much more limited than the existing physical data collected during the PWCM and are not sufficient to meet the needs of the LPR/Newark Bay (NB) Modeling Program. Previous chemical data have been collected by MPI and the New York and New Jersey Harbor Estuary Program (NY/NJ HEP) and are summarized in Worksheet #13 of this QAPP. Although the available data provide some understanding of the concentration of some constituents in the LPR (particularly hydrophobic organic constituents (HOCs)), they are not sufficient to adequately characterize the chemical concentrations throughout the LPRSA and under different flow regimes for use in the calibration or validation of the CFT model. Specifically, a complete set of the required data collected at multiple locations throughout the LPRSA and the NBSA over a range of flow conditions does not exist. Additional data will reduce the level of uncertainty in the LPRSA water column concentrations for use in the RAs, FWM and CFT modeling.

The chemical data collection sampling plan presented in this document has been developed to address the identified data needs and provide the data necessary to characterize chemical concentrations in the water column of the LPRSA and NBSA. The CWCM program is intended to characterize changes in chemical concentrations associated with the movement of suspended sediments over a range of tides and flow regimes.

Broadly defined, the goals of the CWCM Data Collection Program are to:

1. Collect data to support the calibration, validation, and sensitivity analysis of the CFT model. The data will provide information to develop the inputs to the model and to characterize the transport of contaminants in the LPRSA and NBSA, including the preliminary calibration of the flux of contaminants from the sediments to the water column through routine monitoring events. Water column contaminant concentration data collected in the LPRSA and NBSA with sufficient spatial coverage and frequency and over a range of flow conditions will be used to characterize potential gradients, mixing and general inputs to the system.
2. Collect data to characterize the impacts of storm-related high flow conditions on contaminant sources and transport in which resuspension of contaminants from the sediment bed and subsequent deposition from the water column are expected to dominate over other transport processes. Water column contaminant concentration data collected during high flow conditions will be used to assess the potential for increased contaminant loading to the water column from upstream sources and/or through resuspension of existing sediments.
3. Collect data to characterize the transport of contaminants under low flow conditions and maximum tidal excursion, which occurs during low flow conditions at spring tides. Water column contaminant concentration data collected during a combination of low flow and spring tide conditions will be used to better assess the up-river transport potential and support the understanding of the fate and transport for the LPRSA CSM and LPR/NB Model.
4. Estimate average water column concentrations of contaminants in the LPRSA over several seasons and flows for use in exposure point concentration estimation for the HHRA, ERA and FWM.

These monitoring goals have been designed to support the ongoing RI site characterization and modeling efforts. The goals are defined in more detail in Worksheet #11 to this document: PQOs. The PQOs include the DQOs of the project (i.e., what data are needed and how they will be collected).

The field program to achieve the goals stated above is presented in Appendix A: Field Sampling Plan Addendum, which describes the following elements:

- **Routine Events** - Water sample collection is planned at sixteen locations in the LPRSA (including the LPRSA tributaries), above Dundee Dam, Newark Bay, and Newark Bay at its confluences with the Hackensack River, Arthur Kill, and Kill van Kull for chemical analysis. A total of five hundred (500) samples are planned during five routine events spread over winter, spring and summer. The samples will include whole water (unfiltered) and filtered water samples, depending on the analyte. Samples will be filtered for dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc), dissolved methyl mercury, hexavalent chromium, and dissolved solids. Organic carbon will be analyzed for dissolved, total, and particulate phase. Samples for chlorophyll a will consist of the residue from a filtered aliquot of water (i.e., the filter is sent to the laboratory). All other samples will be whole water. The sampling events will be conducted during typical medium flows (400 - 3,000 cfs at Dundee Dam) and will likely bracket several flow regimes over the tidal cycle as well as capture spring and neap tide conditions. Samples will be collected from the deepest part of the river (thalweg) and at two depths (surface and near bottom) for the stations in RM 0 – 17.4 of the LPR and NBSA, and at mid-depth for locations above Dundee Dam and the LPRSA tributaries. The proposed depths (3 feet off the bottom and 3 feet from the surface) were selected with the goal of sampling the relevant layer while avoiding artifacts associated with sampling in close proximity to the sediment bed, the pycnocline, and the water surface. The thalweg will be the targeted location as it is assumed that the denser layer with net inflow is located in the deepest part of the cross section. In addition, the highest velocities are commonly observed at the thalweg so that the rate of discharge (i.e., volume/time) is highest in that location and the collected samples will best represent the dominant flux past that cross-section.
- **High Flow Event** - Water sample collection is planned during high flow conditions (>3,000 cfs at Dundee Dam) at sixteen locations in the LPRSA (including the LPRSA tributaries), above Dundee Dam, Newark Bay, and Newark Bay at its confluences with the Hackensack River, Arthur Kill, and Kill van Kull for chemical analysis. Stations will be generally co-located with stations occupied during the Routine Events. Thirteen of the sixteen stations will be sampled four times each throughout the predicted storm hydrograph; the station above Dundee Dam will be sampled six times throughout the predicted storm hydrograph. The Arthur Kill and Kill van Kull will be sampled just before high and low slack tides. A total of two hundred twelve (212) samples will be collected through two separate high flow events. The samples will include whole water (unfiltered) and filtered water samples, depending on analyte. Samples will be filtered for dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc), dissolved methyl mercury, hexavalent chromium, and dissolved solids. Organic carbon will be analyzed for dissolved, total, and particulate phase. Samples for chlorophyll a will consist of the residue from a filtered aliquot of water (i.e., the filter is sent to the laboratory). All other samples will be whole water. Samples will be collected from two depths (surface and near bottom) at the thalweg for the stations in the LPR (RM 0- 17.4) and NBSA, and at mid-depth for locations above Dundee Dam and the LPRSA tributaries.
- **Low Flow/Spring Tide Event** - Water sample collection is planned during low flow and spring tide conditions at nine locations in the LPRSA and above Dundee Dam for laboratory analysis. Stations will be generally co-located with Routine Event stations. A total of forty-four (44) samples will be collected during the low flow/spring tide event with each station sampled four times during the tidal cycle. The samples will include whole water (unfiltered) and filtered water samples, depending on analyte. Samples will be filtered for dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, and zinc), dissolved methyl mercury, hexavalent chromium, and dissolved solids. Organic carbon will be analyzed for dissolved, total, and particulate phase. Samples for chlorophyll a will consist of the residue from a filtered aliquot of water (i.e., the filter is sent to the laboratory). All other samples will be whole water. Stations in the lower 17.4 miles of the LPR will be

sampled at two depths; stations above Dundee Dam and in the LPRSA tributaries will be sampled from one depth.

As described above, the LPRSA encompasses 17.4 miles of the LPR from Newark Bay upstream to the Dundee Dam, and three major tributaries (Saddle River, Second River, and Third River). In addition to river flow originating above the Dundee Dam, the LPR receives flows from tributaries (e.g., Saddle River, Second River, and Third River) and numerous CSOs and SWOs that provide drainage to the adjacent urban watershed. To provide information to support the calibration and validation of the LPR/NB CFT model, Newark Bay and its major tributaries (Hackensack River, Arthur Kill and Kill van Kull) have been included in the planned Routine and High Flow Events.

QAPP Worksheet #1 (UFP-QAPP Manual Section 2.1) Title and Approval Page

Document Title: Quality Assurance Project Plan/ Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Small Volume Chemical Data Collection. Lower Passaic River Restoration Project.

Lead Organization: Cooperating Parties Group and de maximis, inc.

Preparer's Name and Organizational Affiliation: Kristen Durocher, AECOM

Preparer's Address, Telephone Number, and E-mail Address:

250 Apollo Drive, Chelmsford, MA 01824
603.581.6608
[HYPERLINK "mailto:kristen.durocher@aecom.com"]

Preparation Date (Day/Month/Year): Revision 1, July 2011.

Investigative Organization's Project Manager

Laura a Kelmar

Laura Kelmar / AECOM / July 2011

Investigative Organization's Project Quality Assurance (QA) Manager

Debra L. Simmons

Debra Simmons / AECOM / July 2011

Lead Organization's Project Manager

Bill Potter/ Robert Law/ de maximis, inc. / July 2011

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Site Name/Project Name: **Diamond Alkali Operable Unit (OU 2) - LPRRP RI/FS**

Site Location: **LPRSA and NBSA, New Jersey**
Site Number/Code: **Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) Document No. 02-2007-2009**
Operable Unit: **OU 2 (LPRSA) and OU 3 (NBSA)**
Contractor Name: **AECOM**
Contractor Number: **Not Applicable (NA)**
Contract Title: **NA**
Work Assignment Number: **NA**

1. Identify guidance used to prepare QAPP:

   Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (US Environmental Protection Agency, US Department of Defense, US Department of Energy). USEPA 505-B-04-900A.

2. Identify regulatory program: CERCLA

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a ~~generic~~ or a project-specific QAPP. (circle one)

5. List dates of scoping sessions that were held:

   November 12, 2009
   December 9, 2009
   August 11, 2010

6. List dates and titles of QAPP and FSP documents written for previous site work, if applicable:

Title
CLH 1995. *Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans*. Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.
Tierra Solutions, Inc. 1999. *Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan.* March 1999.
MPI 2005. *Lower Passaic River Restoration Project. Quality Assurance Project Plan.* Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2006. *Lower Passaic River Restoration Project. Field Sampling Plan.* Volume 1. Prepared for US Environmental Protection Agency, US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2007c. *QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation*. December 2007.
ENSR 2008. *Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling*. Revision 4. ENSR, Westford, MA. October 2008.
AECOM 2008. *Lower Passaic River Restoration Project. Bathymetric Surveys. Quality Assurance Project Plan*. AECOM, Westford, MA. October 2008.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Title
Windward 2009a. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA. August 2009.
Windward 2009b. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA. October 2009.
AECOM 2010a. *Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project.* Revision 4. AECOM, Westford, MA. March 2010.
Tierra Solutions, Inc. 2011. *Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area*. Revision 0. May 25, 2011.

7. List organizational partners (stakeholders) and connection with lead organization:

   This work will be performed under the requirements of the Settlement Agreement and SOW with oversight conducted by USEPA and its government partners. de maximis, inc. (acting as Project Coordinator for the CPG), AECOM, and its subcontractors, are conducting the work on behalf of the CPG and Tierra Solutions, Inc.

8. List data users:__See item #7 above.__

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table.
   Provide an explanation for their exclusion below:__N/A__

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	9 9 10 and Introduction Appendix A
2.6 PQOs and Measurement Performance Criteria 2.6.1 Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ Standard Operating Procedure (SOP) Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control (QC) Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 Figure 1, Appendix A 18 19 20 Appendix B 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Appendix C 23 24 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation - Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow - Example Chain-of-Custody Form and Seal	26 Appendix B 27 27 Appendix B
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	- QC Samples Table	28

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management Procedures	29 30 Data Management Plan (DMP) (AECOM 2010b)
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	 - Planned Project Assessments Table - Assessment Findings and Corrective Action Responses Table	3 1 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report	To be completed following data collection	NA
Data Review		
5.1 Overview 5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	To be completed following data evaluation	35

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Stephanie Vaughn	Remedial Project Manager (RPM)	USEPA Region 2	212.637.3914	[HYPERLINK "mailto:vaughn.stephanie@epa.gov"]	
William Sy	Project QA Officer	USEPA Region 2	732.632.4766	[HYPERLINK "mailto:sy.william@epa.gov"]	
Eugenia Naranjo	NBSA RPM	USEPA Region 2	212.637.3467	[HYPERLINK "mailto:naranjo.eugenia@epa.gov"]	
Lisa Baron	Project Manager (PM)	USACE-NY District	917.790.8306	[HYPERLINK "mailto:Lisa.A.Baron@usace.army.mil"]	
Janine MacGregor	Project Coordinator	New Jersey Department of Environmental Protection (NJDEP)	609.633.0784	[HYPERLINK "mailto:Janine.MacGregor@dep.state.nj.us"]	
Tim Kubiak	Assistant Supervisor of Environmental Contaminants	United States Fish and Wildlife Service (USFWS)	609.646.9310 (ext. 26)	[HYPERLINK "mailto:tim_kubiak@fws.gov"]	
Reyhan Mehran	Coastal Resource Coordinator	National Oceanographic and Atmospheric Administration (NOAA)	212.637.3257	[HYPERLINK "mailto:reyhan.mehran@noaa.gov" \o "blocked::mailto:reyhan.mehran@noaa.gov"]	
Bill Potter Robert Law	CPG Project Coordinator	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:otto@demaximis.com"] [HYPERLINK "mailto:rlaw@demaximis.com"]	

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
William Hyatt	Coordinating Counsel	Kirkpatrick and Lockhart Preston Gates Ellis LLP (K&L Gates)	973.848.4045	[HYPERLINK "mailto:william.hyatt@klgates.com"]	
Polly Newbold	CPG QA Coordinator	de maximis Data Management Solutions, Inc. (ddms)	908.479.1975	[HYPERLINK "mailto:pnewbold@ddmsinc.com"]	
Carlie Thompson	Tierra Solutions, Inc. PM NBSA	Tierra Solutions, Inc.	732.246.5849	[HYPERLINK "mailto:Carlie.Thompson@tierra-inc.com"]	
Laura Kelmar	AECOM PM	AECOM	978.905.2266	[HYPERLINK "mailto:Laura.Kelmar@aecom.com"]	
Philip Platcow	AECOM Regional Environmental Health and Safety (EHS) Manager	AECOM	978.905.2100	[HYPERLINK "mailto:Philip.Platcow@aecom.com"]	
Kristen Durocher	Chemical Water Column Monitoring (CWCM) Task Manager	AECOM	603.581.6608	[HYPERLINK "mailto:Kristen.Durocher@aecom.com"]	
Don Kretchmer	Field Team Manager (FTM)/Site Safety Officer (SSO)	AECOM	603.387.0532	[HYPERLINK "mailto:Jeff.Misuik@aecom.com"]	
Debra Simmons	Project QA Manager	AECOM	978.905.2399	D[HYPERLINK "mailto:ebbie.Simmons@aecom.com"]	
Mary Kozik Robert Kennedy	Project Chemist	AECOM	978.905.2277 978.905.2269	MaryO'ConnellKozik@aecom.com Robert.Kennedy@aecom.com	
James Herberich	Data Management Task Manager	AECOM	978.905.2243	[HYPERLINK "mailto:Jim.Herberich@aecom.com	

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
				"]	
Lisa Krowitz	Data Validation Coordinator	AECOM	978.905.2278	[HYPERLINK "mailto:Lisa.Krowitz@aecom.com"]	
Betsy Ruffle	HHRA Task Leader	AECOM	978.905.2377	[HYPERLINK "mailto:Betsy.Ruffle@aecom.com"]	
Rafael Canizares	Modeling Team Task Leader and Liaison	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rcanizares@moffattnichol.com"]	
Mike Johns	ERA Task Leader	Windward Environmental	206.378.1364	[HYPERLINK "mailto:MikeJ@windwardenv.com"]	
Ken Cadmus	Vessel Subcontractor Lead	Ocean Survey, Inc. (OSI)	860.388.4631	[HYPERLINK "mailto:kac@oceansurveys.com"]	
Other project team members and stakeholders					

*Uncontrolled electronic copies will be available on [HYPERLINK "http://www.ourpassaic.org"]

QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization: A completed sign-off sheet will be maintained in the files for each organization represented below.

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read
Bill Potter/Robert Law	CPG Project Coordinator	908.735.9315		
Polly Newbold	CPG QA Coordinator	908.479.1975		
Laura Kelmar	AECOM PM	978.589.3117		
Kristen Durocher	AECOM CWCM Task Manager	603.581.6608		
Don Kretchmer	AECOM FTM/SSO	603.387.0532		
Debra Simmons	AECOM Project QA Manager	978.905.2399		
Mary Kozik	AECOM Project Chemist	978.905.2277		
Robert Kennedy	AECOM Project Chemist	978.905.2269		
James Herberich	AECOM Data Management Task Manager	978.905.2243		
Lisa Krowitz	AECOM Data Validation Coordinator	978.905.2278		
Ken Cadmus	OSI Vessel Subcontractor Lead	860.388.4631		
See Worksheet #30	Laboratory PM	See Worksheet #30		

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

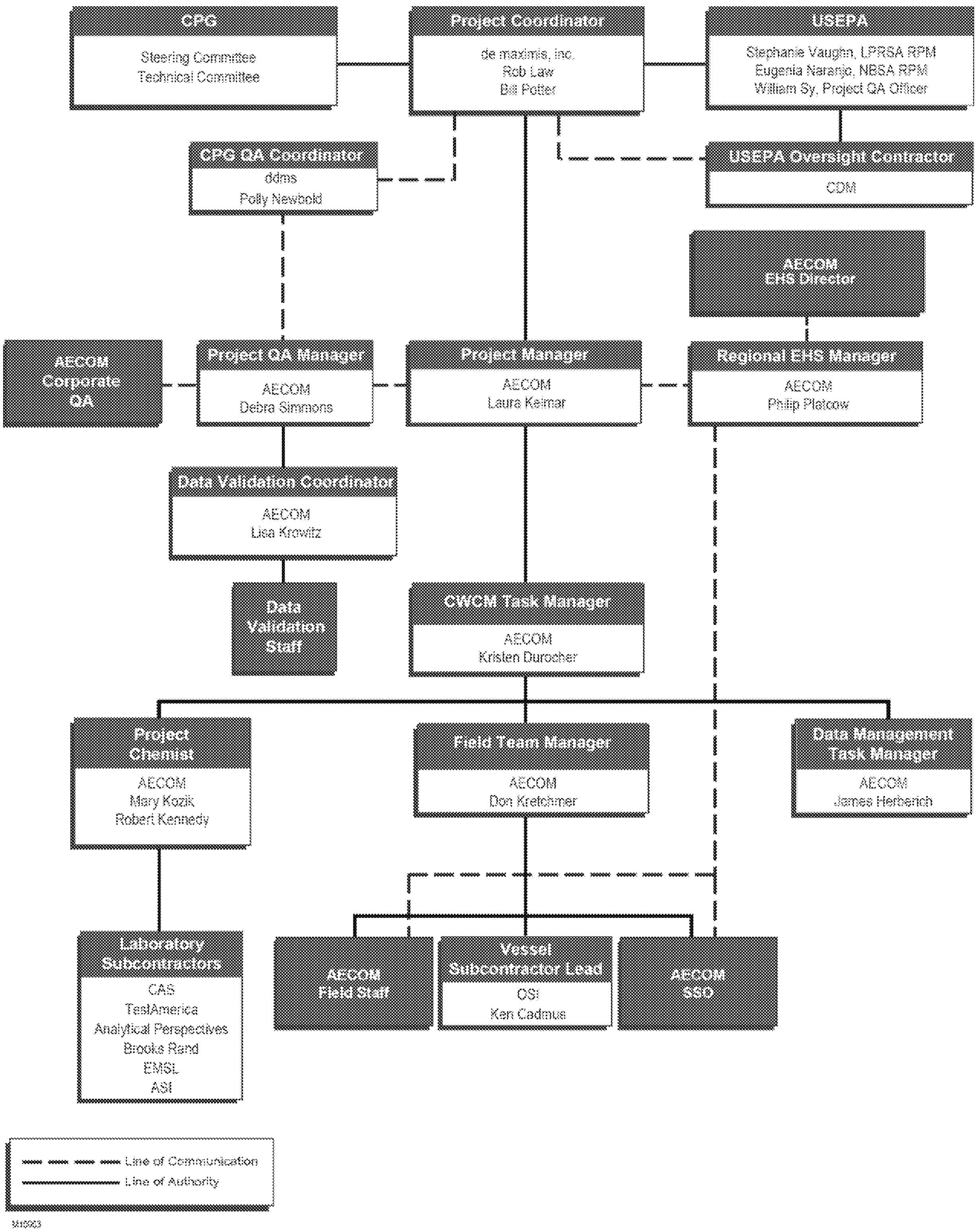
QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization:

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

QAPP Worksheet #5 (UFP-QAPP Manual Section 2.4.1) Project Organizational Chart



[FILENAME \p]

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field activities status and issues	AECOM FTM	Don Kretchmer	603.387.0532	Communicate daily, or as needed, with AECOM field personnel, subcontractors, and AECOM CWCM Task Manager directly, or via e-mail or phone. Minor work plan deviations and/or proposed revisions will be documented and communicated in writing, with a copy sent to USEPA.
	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	Communicate daily with USEPA RPM via e-mail or phone.
Sampling schedule including implementation of flow-dependent sampling	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	The USEPA will be notified as soon as the CPG and its contractors confirm that conditions appear to be favorable for a high flow or low flow sampling event.
Sampling progress/laboratory coordination	AECOM CWCM Task Manager	Kristen Durocher	603.581.6608	Communicate daily, or as needed, with AECOM FTM and Project Chemist via e-mail or phone.
Health and safety briefings and updates	AECOM SSO	Don Kretchmer	603.387.0532	Communicate daily, or as needed, with field personnel and boat operators directly, or via e-mail or phone.
Significant health and safety concerns or incidents	AECOM SSO	Don Kretchmer	603.387.0532	Communicate immediately with AECOM Regional EHS Manager, CWCM Task Manager, and AECOM PM.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Sampling vessel operations	Sampling Vessel Captain	To be determined OSI	860.388.4631	Communicate daily, or as needed, with AECOM FTM directly. The sampling vessel captain has the ultimate authority for stopping work while working on water. The vessel captain, in consultation with the SSO, will follow guidelines documented in the site-specific Health and Safety Plan (HASP). In addition, standard safe boating practices related to weather conditions and vessel operations will apply, even if not specifically addressed in the HASP.
Analytical laboratory issues, including coordination with field, schedule, and technical issues	AECOM Project Chemist	Mary Kozik Robert Kennedy	978.905.2277 978.905.2269	Communicate with AECOM FTM and Laboratory PM as needed via phone or e-mail.
Analytical data validation issues	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Laboratory PM as needed via phone or email.
Audit findings (field and/or laboratory)	AECOM Project QA Manager	Debra Simmons	978.905.2399	Communicate findings to AECOM CWCM Task Manager or Laboratory PM (as appropriate); transmit final audit reports, including corrective actions (CA), to AECOM PM, AECOM CWCM Task Manager, CPG Project Coordinator, and CPG QA Coordinator.
	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	CPG Project Coordinator will communicate results of audit to USEPA RPM.
Issues potentially affecting PQOs	AECOM FTM	Don Kretchmer	603.387.0532	Communicate as needed with AECOM QA Manager and AECOM CWCM Task Manager via
	OSI Vessel Subcontractor Lead	Ken Cadmus	860.388.4631	

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
	AECOM Project Chemist	Mary Kozik Robert Kennedy	978.905.2277978.905.2269	e-mail or phone. Notification of the CPG QA Coordinator as appropriate.
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	
	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	CPG Project Coordinator will communicate to USEPA RPM.
	AECOM CWCM Task Manager	Kristen Durocher	603.581.6608	Communicate with AECOM QA Manager and AECOM PM as needed, via e-mail or phone. Notification of the CPG QA Coordinator as appropriate. Significant work plan modifications will be reported to USEPA in writing prior to implementation.
Water sample collection task implementation, including sampling, analysis, and reporting	AECOM FTM	Don Kretchmer	603.387.0532	Communicate with AECOM CWCM Task Manager as needed, via e-mail or phone.
	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	Communicate daily with USEPA RPM via e-mail or phone.
Project status and issues (internal)	AECOM PM	Laura Kelmar	978.905.2266	Communicate with CPG Project Coordinator daily, or as needed, via email or phone, and submit monthly progress reports.
Project status and issues (external)	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	Communicate with USEPA RPM as needed via e-mail or phone.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
	CPG Coordinating Counsel	William Hyatt / Dawn Monsen (K&L Gates)	973.848.4045 or 4148	In the event the CPG Project Coordinator is unavailable for communication with USEPA, the AECOM PM will notify the Coordinating Counsel prior to contacting USEPA.
Quality status and issues	CPG QA Coordinator	Polly Newbold	908.479.1975	Communicate with CPG Project Coordinator as needed via email or telephone
Data management	AECOM FTM	Don Kretchmer	603.387.0532	Communicate with the Data Management Task Manager via email; transmit final field locations and sample collection information daily.
	AECOM Data Management Task Leader	Jim Herberich	978.905.2243	Maintain comprehensive project technical database, communicate with AECOM FTM to receive data from the field; communicate with Laboratory PM(s) to receive analytical result data, communicate with AECOM Data Validation Coordinator to facilitate validation review and database update; communicate with AECOM CWCM Task Manager to provide data for review; and provide data deliverables to USEPA.
	Laboratory PM	See Worksheet #30	See Worksheet #30	Transmit Electronic Data Deliverables (EDDs) to Data Management Task Manager
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Data Management Task Manager regarding final data qualifiers.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Stop Work (technical non-compliance)	AECOM Field team, Project QA Manager, Project Chemists, and Data Management Task Manager			Any personnel believing that a work stoppage is necessary shall first verbally notify the CWCM Task Manager or the AECOM PM, who will in turn verbally notify de maximis, inc. and/or AECOM Project QA Manager, if necessary. Given the potential significance of such communications, this will occur as quickly as possible.
	CPG Project Coordinator	Bill Potter/ Robert Law (de maximis, inc.)	908.735.9315	Communicate any stop work order to USEPA RPM via e-mail or phone.

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[1]
Robert Law	CPG Project Coordinator	de maximis, inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project quality assurance/quality control (QA/QC), and Health and Safety including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	PhD, Geology, 26 years experience
Willard Potter	CPG Project Coordinator	de maximis, inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and Health and Safety including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	BS, Chemical Engineering, 36 years experience
Laura Kelmar	AECOM PM	AECOM	Overall responsibility for completion of RI tasks in accordance with SOW requirements including technical, financial, and scheduling. Primary point of contact with CPG Project Coordinator.	BS, Chemical Engineering, MS, Environmental Engineering, 20 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[1]
Kristen Durocher	CWCM Task Manager	AECOM	Responsible for the execution and completion of the CWCM program, including procurement of subcontractors, review of task deliverables, and serving as the focus for coordination of all field and laboratory tasks. The CWCM Task Manager will keep the AECOM PM apprised of the status of the task, as well communicate any issues with the schedule, budget, or achievement of the task objectives.	BA Environmental Studies and Northern Studies, 18 years experience
Don Kretchmer (or designee)	FTM	AECOM	Responsible for implementing field sampling activities in accordance with the approved plans (FSP, QAPP, and HASP). Primary responsibilities include directing activities on site, monitoring subcontractor performance in the field, reviewing field records, and communicating daily with the AECOM CWCM Task Manager regarding status, quality, issues, or delays.	BS Natural Resources, MS Water Resource Management, 26 years experience
Debra Simmons	Project QA Manager	AECOM	Responsible for reviewing and approving QA procedures, ensuring that planned QA assessments (e.g., technical surveillance audits [TSA], data validation) are conducted according to the QAPP/FSP Addendum and the AECOM Quality Management Plan (QMP), (AECOM 2009) and reporting on the adequacy of the QA Program to the AECOM PM.	BS, Biology, 28 years experience
Philip Platcow	Regional EHS Manager	AECOM	Responsible for ensuring that the objectives of AECOM's Health and Safety Program are met and for monitoring task activities for conformance to the HASP.	MS, Industrial Hygiene, 25 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[1]
Don Kretchmer (or designee)	SSO	AECOM	Responsible for monitoring subcontractor/field team performance in the field and communicating daily with the AECOM FTM, CWCM Task Manager or Regional EHS Manager, as appropriate, regarding health and safety, etc. Will ensure that the objectives of the project's Health and Safety Program are met.	BS Natural Resources, MS Water Resource Management, 26 years experience
Mary Kozik	Project Chemist	AECOM	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratory(ies). The Project Chemist will also be responsible for communicating any issues that could affect achievement of the PQOs to the AECOM CWCM Task Manager and the AECOM Project QA Manager.	MS, Chemistry, 32 years experience
Robert Kennedy	Project Chemist	AECOM	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratory(ies). The Project Chemist will also be responsible for communicating any issues that could affect achievement of the PQOs to the AECOM CWCM Task Manager and the AECOM Project QA Manager.	BA, Chemistry, 27 years experience
Lisa Krowitz	Data Validation Coordinator	AECOM	Responsible for managing the validation task, including ensuring that validation is conducted and documented according to the requirements of this QAPP, and interacting with the laboratories to resolve any issues.	MS, Environmental Science, 24 years experience
James Herberich	Data Management Task Manager	AECOM	Responsible for data management for project, Including overall responsibility for database quality and structure, including graphical representation of data.	BA, Engineering Sciences, 22 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[1]
Polly Newbold	CPG QA Coordinator	ddms, inc.	Provides oversight of project QA/QC. Periodically review and audit operations to ensure that QAPP/FSP Addendum QA/QC procedures are being followed.	BS, Textile Science, 26 years experience
Ken Cadmus	Vessel Subcontractor Lead	OSI	Responsible for vessel operation, providing crew and equipment. Acts as the primary point of contact between AECOM FTM and CWCM Task Manager and vessel crew.	MS, Civil Engineering, 16 years experience
John Reynolds	Laboratory PM	TestAmerica	Acts as the primary point of contact at TestAmerica facilities for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all TestAmerica network laboratories.	BS, Biology, 16 years experience
Ed Wallace	Laboratory PM	Columbia Analytical Services (CAS)	Acts as the primary point of contact at CAS facilities for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all CAS network laboratories	MS, Chemistry, 34 years experience
Misty Kennard-Mayer	Laboratory PM	Brooks Rand, LLC	Acts as the primary point of contact at Brooks Rand, LLC for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Environmental Science, 7 years experience
Todd Vilen	Laboratory PM	Analytical Perspectives	Acts as the primary point of contact at Analytical Perspectives for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BA, Chemistry; BS, Aquatic Biology, 24 years experience
Jason Dobranic	Laboratory PM	Environmental Molecular Sciences Laboratory (EMSL), Inc.	Acts as the primary point of contact at EMSL for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	PhD, Microbiology, 9 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications[1]
Paul Warden	Laboratory PM	Analytical Services, Inc. (ASI)	Acts as the primary point of contact at ASI for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Biology, 20+ years experience

[1] Resumes of all individuals are available upon request.

QAPP Worksheet #8 (UFP-QAPP Manual Section 2.4.4) Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
FTM/SSO	40 hour Hazardous Waste Operations and Emergency Response (HAZWOPER)	Compliance Solutions	July 2011	Don Kretchmer	FTM/SSO/AECOM	AECOM
Field Personnel	40 hour HAZWOPER	AECOM	Various	Various	Various/AECOM	AECOM
	HAZWOPER 8-hr Refresher	AECOM	within 12 mo			
	Hazmat awareness	AECOM	Various			
Sampling Vessel Captain	40 hour HAZWOPER	Varies	Various	Various Captains	OSI	OSI
	HAZWOPER 8-hr Refresher	Varies	within 12 mo			
	U.S. Coast Guard license	U.S. Coast Guard	Various			
	First Aid/CPR	Varies	within 24 mo			

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI Water Column Monitoring/Small Volume Chemical Data Collection **Projected Date(s) of Sampling: October 2010** **Project Manager: Bill Potter/ Robert Law**			**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA**	
Date of Session: November 12, 2009 **Scoping Session Purpose: Discussion among de maximis, inc./ AECOM/Windward/Moffatt & Nichol for 2010 CWCM program.**				
Name	**Affiliation**	**Phone #**	**E-mail Address**	**Project Role**
Bill Potter	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:otto@demaximis.com"]	CPG Project Coordinator
Robert Law	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:rlaw@demaximis.com"]	CPG Project Coordinator
Bill Lee	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:wjlee@demaximis.com"]	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	kristen.durocher.[HYPERLINK "mailto:Nakles@aecom.com"]	CWCM Task Manager
Mike Sanborn	AECOM	250.475.6355	[HYPERLINK "mailto:Mike.sanborn@aecom.com"]	AECOM planning team
Doug Bright	AECOM	250.475.6355	[HYPERLINK "mailto:Doug.bright@aecom.com"]	AECOM planning team
Robert Kennedy	AECOM	978.589.3343	[HYPERLINK "mailto:Robert.kennedy@aecom.com"]	AECOM planning team
Tim Iannuzzi	ARCADIS for Tierra Solutions, Inc.	410.295.1205	[HYPERLINK "mailto:tim.ianuzzi@arcadis-us.com"]	Technical Committee (TC) member
Alain Hebert	ARCADIS for Tierra Solutions, Inc.	609.860.0597	[HYPERLINK "mailto:ahebert@bbl-inc.com"]	TC member
Diane Waldschmidt	EDS for Tierra Solutions,, Inc.	412.486.6989	[HYPERLINK "mailto:edatas@aol.com"]	TC member
Cliff Firstenberg	Tierra Solutions, Inc.	757.258.7720	[HYPERLINK "mailto:cefirstenberg@cox.net"]	TC member
Kavin Ghandi	ARCADIS for Tierra Solutions, Inc.	609.860.0597	[HYPERLINK "mailto:Kavin.Gandhi@arcadis-us.com"]	TC member

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Paul Brzozowski	Tierra Solutions, Inc.	732.426.5851	[HYPERLINK "mailto:Paul.brzozowski@tierra-inc.com"]	TC member
Betsy Ruffle	AECOM	978.589.3071	[HYPERLINK "mailto:Betsy.ruffle@aecom.com"]	HHRA team
Lisa Saban	Windward Environmental	206.378.1364	[HYPERLINK "mailto:lisas@winwardenv.com"]	ERA team FWM team
Rafael Canizares	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rcanizares@moffattnichol.com"]	CFT modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rmathew@moffattnichol.com"]	CFT modeling team

Comments/Decisions:

Representatives of the LPR Project Team met to discuss options for collecting chemical water column data. High volume techniques were discussed, and the group determined that DQOs and data use objectives (DUOs) were not well defined for the CWCM program. As a result of this meeting, it was agreed that a scoping meeting with TC members should be convened once DQOs and DUOs were well defined. This meeting was scheduled for December 9, 2009 in Newark, New Jersey.

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI Water Column Monitoring/Small Volume Chemical Data Collection
Projected Date(s) of Sampling: October 2010
Project Manager: Bill Potter/ Robert Law

Site Name : Diamond Alkali OU 2 - LPRRP RI/FS
Site Location : LPRSA

Date of Session: December 9, 2009
Scoping Session Purpose: Discussion among de maximis, inc./ AECOM/Windward/Moffatt & Nichol for DQO/DUOs 2010 CWCM program.

Name	Affiliation	Phone #	E-mail Address	Project Role
Robert Law	de maximis	908.735.9315	[HYPERLINK "mailto:rlaw@demaximis.com"]	CPG Project Coordinator
Bill Lee	de maximis	908.735.9315	[HYPERLINK "mailto:wjlee@demaximis.com"]	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	kristen.durocher.[HYPERLINK "mailto:Nakles@aecom.com"]	CWCM Task Manager
Doug Bright	AECOM	250.475.6355	[HYPERLINK "mailto:Doug.bright@aecom.com"]	AECOM planning team
Robert Kennedy	AECOM	978.589.3343	[HYPERLINK "mailto:Robert.kennedy@aecom.com"]	AECOM planning team
Tim Iannuzzi	ARCADIS for Tierra Solutions, Inc.	410.295.1205	[HYPERLINK "mailto:tim.ianuzzi@arcadis-us.com"]	TC member
Diane Waldschmidt	EDS for Tierra Solutions, Inc.	412.486.6989	[HYPERLINK "mailto:edatas@aol.com"]	TC member
Cliff Firstenberg	Tierra Solutions, Inc.	757.258.7720	[HYPERLINK "mailto:cefirstenberg@cox.net"]	TC member
Paul Brzozowski	Tierra Solutions, Inc.	732.426.5851	[HYPERLINK "mailto:Paul.brzozowski@tierra-inc.com"]	TC member
Suzanne Replinger	Windward Environmental	206.378.1364	[HYPERLINK "mailto:suzanner@windwardenv.com"]	ERA team
Karen Tobiason	Windward Environmental	206.378.1364	[HYPERLINK "mailto:karent@winwardenv.com"]	ERA team

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Rafael Canizares	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rcanizares@moffattnichol.com"]	CFT modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rmathew@moffattnichol.com"]	CFT modeling team
Leo Postma	Deltares	31.(0)15.285.8	[HYPERLINK "mailto:Leo.postma@deltares.nl"]	CFT modeling team
Richard Wroblewski	Givaudan Fragrances Corp.	973.448.6339	[HYPERLINK "mailto:Richard.Wroblewski@givaudan.com"]	TC member

Comments/Decisions:

The above parties discussed the development of the CWCM program, with the DUOs and DQOs defined by the end users (RA and modeling teams). It was determined that the best approach to the CWCM program was to provide a phased approach, including both small volume and high volume sampling. This is consistent with FSP1 (MPI 2006).

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI Water Column Monitoring/Small Volume Chemical Data Collection **Projected Date(s) of Sampling: October 2010** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA**

Date of Session: August 11, 2010

Scoping Session Purpose: Discussion among de maximis, inc./ AECOM/ Moffatt & Nichol/USEPA for 2010 small volume CWCM program.

Name	Affiliation	Phone #	E-mail Address	Project Role
Bill Potter	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:otto@demaximis.com"]	CPG Project Coordinator
Robert Law	de maximis, inc.	908.735.9315	[HYPERLINK "mailto:rlaw@demaximis.com"]	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	kristen.durocher.[HYPERLINK "mailto:Nakles@aecom.com"]	CWCM Task Manager
Alice Yeh	USEPA	212.637.4427	[HYPERLINK "mailto:Yeh.alice@epa.gov"]	USEPA RPM
AmyMarie Accardi-Dey	Louis Berger, Inc.	914.798.3712	[HYPERLINK "mailto:aacardidey@loiusberger.com"]	NBSA oversight for USEPA
William Sy	USEPA	732.632.4766	[HYPERLINK "mailto:Sy.william@epa.gov"]	Project
Ed Garland	HydroQual, Inc.	201.529.5151	[HYPERLINK "mailto:Egardland@hydrolqual.com"]	USEPA consultant
Ed Garvey	Louis Berger, Inc.	914.798.3712	[HYPERLINK "mailto:egarvey@louisberger.com"]	NBSA oversight for USEPA
Elizabeth Barrows	Battelle	631.941.3213	[HYPERLINK "mailto:barrowse@battelle.org"]	USEPA consultant
Eugenia Naranjo	USEPA	212.637.3558	[HYPERLINK "mailto:Naranjo.eugenia@epa.gov"]	NBSA RPM
Jim Fitzpatrick	HydroQual, Inc.	201.529.5151	[HYPERLINK "mailto:jfitzpatrick@hydroqual.com"]	USEPA consultant

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Liz Butler	USEPA	212.637.4396	[HYPERLINK "mailto:Butler.elizabeth@epa.gov"]	USEPA
Marian Olsen	USEPA	212.637.4313	[HYPERLINK "mailto:Olsen.marian@epa.gov"]	USEPA HHRA
Pravi Shrestha	Exponent	949.242.6037	[HYPERLINK "mailto:pshretha@exponent.com"]	Tierra Solutions, Inc. consultant
Ricardo Petroni	Anchor-QEA	201.930.9890	[HYPERLINK "mailto:rpetroni@anchorqea.com"]	TC consultant
Sharon Budney	CDM	732.590.4662	[HYPERLINK "mailto:budneysl@cdm.com"]	USEPA consultant
Stephanie Vaughn	USEPA	212.637.3914	[HYPERLINK "mailto:Vaughn.stephanie@epa.gov"]	LPRSA RPM
Tom Gallagher	HydroQual, Inc.	201.529.5151	[HYPERLINK "mailto:tgallagher@hydrolqual.com"]	USEPA consultant
Rafael Canizares	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rcanizares@moffattnichol.com"]	CFT modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	[HYPERLINK "mailto:rmathew@moffattnichol.com"]	CFT modeling team

Comments/Decisions:

Representatives of the CPG LPR Project Team met with USEPA and its contractors to discuss the overall scope of the CWCM program, and the general terms of the small volume QAPP.

The overall design of the small volume CWCM program was presented to USEPA and its contractors. The program outline was framed within the context of the larger CWCM program, which will include high volume sampling which will be provided in a separate QAPP/FSP Addendum.

The program is complex and several questions were asked for clarification purposes by USEPA and its contractors:

1) What are the criteria for the Low Flow sampling event? Flow at what gauge needs to be maintained for how long?

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Response: The river gage at Dundee Dam will be the point for which all events will be measured. When flow in the river at Dundee Dam reaches and maintains no more than 500 cubic feet per second (cfs), a Low Flow sampling event may occur.

2) Will the small volume QAPP include information about the high volume program, including number of samples, number of stations, number of events, and analyte list?

Response: The high volume program is still being developed. The CPG and its contractors would like to meet with USEPA and their contractors to discuss the high volume program. The small volume QAPP will allude to the high volume program, and the overall draft data use objectives for the high volume program.

3) There were sampling constraints associated with the PWCM program due to short hold times associated with some of the analytes. Will the CWCM have the same constraints? (CDM)

Response: Yes, the priority analyte list for the CWCM small volume program includes the same physical parameters sampled during the PWCM program, some of which have 48 hr holding times. (may have been Sharon Budney, CDM)

4) What are the procedures that will trigger a sampling event, particularly the storm events? How will this be relayed to the USEPA and its contractors? (CDM)

Response: Similar to the communication protocol in place for the PWCM program, the USEPA will be notified as soon as the CPG and its contractors confirm that conditions appear to be favorable for a storm sampling event. The specific communication protocol will be provided in Worksheet #6 of the small volume QAPP.

5) Why aren't PAHs included in the priority analyte suite? (Ed Garvey, LBI)

Response: The priority analyte suite was selected based on the parameters identified in the Modeling Work Plan (MWP) for model calibration. The MWP specifically identifies PCDD/PCDF and PCB congeners for model calibration. The CPG has included mercury to that list. The proposed priority analyte suite is adequate to meet the DUO for model calibration in the MWP.

6) Why aren't OC pesticides included in the analyte suite? And should PAHs be analyzed using high resolution methods? (AmyMarie Accardi-Dey, LBI)

Response: OC pesticides are part of the full analyte suite, and were left off the slide unintentionally. They will be analyzed using high resolution methods. PAHs will be analyzed by Selective Ion Monitoring (SIM) techniques.

7) If the priority analyte suite chemicals are not detected using these small volumes, will the CPG continue to collect these data? (AmyMarie Accadi-Dey, LBI)

Response: Yes. The model can use non-detects, and the data can be used to provide some information regarding concentrations of these analytes.

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

8) Please explain the criteria for reducing the sampling from four times per tidal cycle to two times per tidal cycle.(AmyMarie Accardi-Dey LBI)

Response: Following two rounds of Routine Event sampling (when samples are collected four times per tidal cycle at each location), the data will be reviewed. If there are few differences in the concentrations of priority constituents, USEPA will be consulted to determine if reducing the sampling to twice per tide cycle would still allow the program to meet DUOs while substantially reducing analytical costs.

9) A comment was made that analysis of the contaminant concentration in the solids fraction of the boundary conditions (i.e., tributaries), rather than the whole water sample, would be the most useful data for estimation of inputs from the LPRSA tributary boundaries. (Ed Garvey, LBI)

10) Based on a question by AmyMarie Accardi-Dey (LBI), clarification was provided that the small volume program would utilize “standard” water volumes, such as 1 to 2 liters for SVOCs, and that the high volume program would utilize large volumes (as needed) to lower the detection limits to meet RA data quality levels.

11) Based on a question from Ed Garvey (LBI), clarification was provided that the small volume program would provide whole water data, with the exception of some metals for which aquatic life water quality criteria were based on the dissolved fraction, and hexavalent chromium, which would be dissolved phase only. The high volume program would provide dissolved water column organic concentrations, and the associated concentrations on the solid fraction. The high volume program would provide any site-specific partitioning coefficients to the model. The model does not integrate variability of partitioning coefficients.

12) Clarification to the number of samples collected at each location was provided as concerns were expressed by Ed Garvey (LBI) that only one sample data point would be available per station.

13) A general description of the high volume program was provided indicating that the CPG is considering an Infiltrex-type system will be used to sample and at least two sampling events would occur. The numbers of locations, analyte list and specific methods have yet to be determined.

As a result of this meeting, it was agreed that a scoping meeting with USEPA and their contractors should be convened to discuss the high volume program. This meeting was not scheduled. Further, it was acknowledged that the small volume QAPP would be provided to USEPA by Labor Day 2010.

QAPP Worksheet #10 (UFP-QAPP Manual Section 2.5.2) Problem Definition

The problem to be addressed by the project:

The proposed sampling program consists of the collection of water column samples to support the characterization of the nature and extent of contaminants in the water column in order to understand the characteristics of the water column in the main stem of the LPR (extending from RM 0 to RM 17.4), the major LPRSA tributaries (Saddle River, Second River, Third River), above Dundee Dam, and within Newark Bay and its confluences with the Hackensack River, Arthur Kill, and Kill van Kull. Chemical water column sampling supports the understanding of the nature and extent of contaminants, and provides data to conduct the RAs and FWM model, and LPR/NB CFT model. CWCM is a required element of LPRRP FSP1 for completion of the LPRSA RI/FS per the May 2007 Settlement Agreement and SOW (USEPA 2007a).

The field and laboratory data collected during this program will be utilized in completion of the RI/ FS to:

- Understand the relationship between tidal stage, freshwater flow and salinity patterns, and chemical concentrations in the water column. This investigation has been designed to evaluate a range of hydrologic conditions (e.g., high and low watershed runoff) in order to understand the influence of these conditions on water column contaminant concentrations;
- Aid in the characterization of potential internal and external sources of contaminants;
- Characterize the variation in chemical concentrations within the water column under different hydrologic events and in space; and
- Provide information on the temporal and spatial concentrations of contaminants in the water column for use in the RAs and modeling programs that are currently a part of the LPRSA and NB RIs.

The introduction to the QAPP provides background site information. The PQOs provided in Worksheet #11 include more detail for each sampling objective.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?
CPG, Tierra Solutions, Inc. and USEPA will use these data for CERCLA-related assessments, including the LPRSA RAs and FWM, the LPR/NB CFT Model and other tasks associated with both the LPRSA RI/FS and the NBSA RI/FS.
What will the data be used for?
The following presents the DUOs for the CWCM small volume chemical data collection program: • The data will be used as part of the overall RI/FS to characterize the nature and extent of contaminants in surface water. • Consistent with the *LPRSA Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation Document* (PFD) (Windward and AECOM 2009), the data will be used to assess potential exposure dose and risk from direct contact (i.e., incidental ingestion, dermal contact, inhalation of volatiles) with chemicals of potential concern (COPCs) in surface water by human receptors; • Consistent with the PFD (Windward and AECOM 2009), the data will be used to assess potential exposure dose or concentration and potential risk from ingestion and/or direct contact with chemicals of potential ecological concern (COPECs) in surface water by: – aquatic plants (direct contact only), – zooplankton, – benthic invertebrate community, – macroinvertebrates, – mollusks, – benthic fish, – pelagic fish, – amphibians/reptiles (direct contact only), – herbivorous and omnivorous birds (ingestion only), – sediment-probing shorebirds (ingestion only), – piscivorous birds (ingestion only), and – piscivorous mammals (ingestion only).

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- Concentrations of COPCs in surface water will also be compared to applicable, relevant or appropriate requirements (ARARs) (e.g., state or federal water quality standards).
- The data will be used to estimate contribution of COPCs in surface water to the bioaccumulation of COPCs in the food chain.
- The data will be used to support the CFT model specifically for:
  - Characterization of the initial conditions;
  - Calibration, validation and sensitivity testing of the CFT model under various flow conditions; and,
  - Development of contaminant loadings to the model.

What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?

Worksheet #15 provides a full list of constituents. The analyte list as outlined in the Fish/Decapod QAPP and Benthic QAPP (Windward 2009a 2009b) was used as the basis for the development of the proposed chemistry analyte list for the small volume CWCM program. This list includes the target analytes for the HHRA, ERA and FWM including PAHs, alkyl PAHS, butyltins, TAL metals, titanium, hexavalent chromium, mercury and methyl mercury, PCB congeners and homologs, PCDD/PCDFs, OC pesticides, TCL SVOCs (plus TICs), and TCL VOCs (plus TICs). Additional physical parameters such as major anions, nitrogen, alkalinity, hardness (as a calculated value), solids fractions, chlorophyll a, phosphorous, and organic carbon fractions will also be collected to support the FWM and CFT model. All samples submitted for analysis will be analyzed as whole water except as noted above.

As the initial phase of the CWCM data collection, this investigation will include a number of analyses. All proposed analyses have been assigned to one of four groups described in the following paragraphs:

Group A - A list of target physical, and inorganic and organic chemical analyses is proposed for the full set of stations and depths (refer to Worksheet #15). These analytes will be measured in all samples during each of the eight events and will be used primarily for estimation of EPCs for the HHRA, ERA and FWM, and in the CFT model calibration. This analyte list is consistent with the Modeling Work Plan (HydroQual, 2006) and includes PCDD/PCDFs, PCB congeners and homologs, mercury (total and dissolved), and supporting parameters to be used in the CFT model (i.e., DOC, POC, SSC, TOC, chlorophyll a, alkalinity, sulfate, total sulfide, TDS, and chloride). Total and dissolved cadmium, copper and lead are also included in the Group A list.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Group B - A list of physical, and inorganic and organic chemical analyses is proposed for the full set of stations and depths for a subset of sampling events (refer to Worksheet #15). These parameters will be used to support EPC calculations for the HHRA, ERA and FWM, as well as validation of the CFT model, and include TCL SVOCs, TCL VOCs, TAL metals, a subset of TAL metals in dissolved phase (arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc), titanium, methyl mercury (total and dissolved), hexavalent chromium (dissolved only), butyltins, OC pesticides, cyanide, PAHs, alkyl PAHs, hardness (calculated), TKN, ammonia and total phosphorus. TICs reported in association with the TCL VOC and SVOC analyses could potentially provide information on the need for alternative methods. Group B analyte data will be used to validate the model and in the RI and RAs. Group B will not be analyzed in winter and spring, as potential exposures and biological activity are lower than in other seasons.

Group C - Pathogen analyses are proposed for near-surface samples from five stations in RM 0 - 17.4 of the LPR to determine their relevance in future investigation phases. The five stations, shown in Worksheet #18, were selected by reviewing the sample maps to ensure coverage within the full length of the river, with a focus on areas of where CSOs are present and to provide information regarding the input of pathogens during storm events from off-site sources. Group C will be sampled during spring and summer routine events, the low flow/spring tide event, and both high flow events and includes total coliform and *E. coli*, fecal coliform, fecal streptococci and fecal enterococci bacteria.

Group D - Additional pathogen analyses are proposed for near-surface samples from the five stations in RM 0 - 17.4 of the LPR to determine their relevance in future investigation phases. These five stations are the same stations sampled for Group C analytes, but during fewer sampling events. Group D includes the protozoans *Giardia* and cryptosporidium and will be sampled during summer routine events and both high flow events.

Specific stations designated for the additional Group C and D analyses are noted in Worksheet #18.

Field measurements will include continuous surface to near-bottom measurements of dissolved oxygen, pH, specific conductivity, temperature, and salinity. Physical, chemical, and biological/pathogen tests will be performed on the water samples at the laboratories identified in Worksheet #30 according to methods listed in Worksheet #23.

For the LPRSA RAs and FWM:

- Total concentrations of target analytes are needed for evaluation of the ingestion, dermal contact, direct contact, and inhalation (volatilization) pathways.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- Dissolved concentrations are needed for evaluation of metals that have water quality criteria that are based on the dissolved fraction. Due to the analytical method, hexavalent chromium will be collected in filtered samples only (i.e., the dissolved fraction).
- To aid in characterizing background conditions, analysis of a subset of samples for bacterial and protozoan pathogens will be included. Characterization will include the variability and short-term (acute) concentrations in human pathogen levels under varying conditions such as flow and seasonality.
- Samples that characterize concentrations in the upper few feet of the water column (e.g., 0-3 ft) will be used for evaluating potential human exposures to COPCs during activities such as swimming or wading. This will be achieved by collecting near surface samples at locations in the tidal part of the river and mid-column samples in the shallower non-tidal part of the river.
- Samples that characterize concentrations throughout the water column are appropriate for evaluating potential ecological exposures to COPECs. This will be achieved by collecting near surface and near bottom samples at locations in the tidal part of the river and mid-column samples in the shallower non-tidal part of the river.

For the LPR/NB CFT model:

- Total concentrations of target analytes are needed for model calibration, validation, and sensitivity analysis, and for developing contaminant loadings to the model. Specific data usage for calibration and validation is provided in the Modeling Work Plan (HydroQual 2006).
- Parameters such as suspended solids, pH, salinity, chlorophyll a, dissolved and particulate organic carbon, major anions (sulfates, chlorides, alkalinity, and sulfide), TDS, temperature, and dissolved oxygen will be measured to aid in characterizing background conditions, as well as for use in developing inputs of adsorbents to the CFT model.

How "good" do the data need to be in order to support the environmental decision?

- The data need to meet project action limits (PALs)) based on the lower of human health and ecological criteria (e.g., national recommended water quality criteria, New Jersey water quality standards). The PALs are presented in Worksheet #15. Not all PALs will be met in the small volume sampling program. These data will be used to inform the development of the high volume sampling program, which will, in part, address small volume data needs where PALs were not achieved. For constituents that meet the PALs, or where frequency of detection is high enough to provide the data necessary to calibrate and validate the CFT model, additional data needs will be fewer. Where PALs are not met or the frequency of detection is not adequate to meet the project quality objectives, constituents will be reviewed for inclusion in the high volume

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

sampling program (in prep). The high volume sampling program PQOs will be determined using the results of the small volume program. At a minimum, high volume sampling data will be collected to augment the development of partitioning parameters for use in the CFT model.

- Following the first Routine Event, a subset of 20 samples will be analyzed using rapid turnaround time for the Group A analytes. The results of these samples will serve as the first evaluation of the ability of the data to support the environmental decision. Upon receipt of the data from the laboratory, USEPA, CPG and Tierra will review the data to determine the efficacy of the small volume methods to achieve the PQOs. The CPG and Tierra will provide opinions to USEPA, who will make the final determination. No additional sampling will occur until an agreement is reached on the results of the first event Group A sample analyses.
- Upon completion of the first two Routine Events and throughout the duration of the small volume program, the overall quality of the data will be examined. If groups of chemicals are undetected or rejected, the small volume program will be re-assessed and may be modified.
- The data need to be collected and analyzed in conformance with various USEPA Region 2 quality assurance guidance and manuals (http://www.epa.gov/region2/qa/documents.htm).

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

For the LPRSA RAs and FWM:

- Sample collection is planned throughout the LPRSA (RM 0 to 17.4 and the LPRSA tributaries) and above Dundee Dam.
- The number of samples for the target analytes is planned to be sufficient to calculate average temporal concentrations as described in the next section, including the ability to calculate average concentrations at sampling locations within the potential human or ecological exposure areas in the river. The definition of exposure areas is ongoing as information regarding access, shoreline characteristics, and human uses is collected throughout the RI/FS process. The amount of data being collected from the LPRSA should be sufficient to calculate the necessary exposure point concentrations with statistical confidence. Two hundred (200) samples will be collected from the LPR between RM 0 – 17.4 during the small volume program; 40 samples from each of the five locations. This number of samples is intended to be sufficient to calculate Upper Confidence Limits (UCLs) of average concentrations depending upon the exposure scenario.

For the LPR/NB CFT model:

- Samples collection is planned throughout the LPRSA (RM 0 to 17.4 and the LPRSA tributaries), above Dundee Dam, in Newark Bay and its confluences with the Hackensack River, Arthur Kill and Kill van Kull.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

• The data need to be representative of the various processes in the CFT model such that the diffusive flux rate from the sediment to the water column, resuspension/deposition during storm events, tidal mixing and transport through the salt wedge can be characterized to support the preliminary model calibration and validation. Specifics on the model calibration, validation and sensitivity analysis processes are provided in the Modeling Work Plan (HydroQual 2006). • A minimum of eight events are proposed to capture data representative of processes (see HydroQual 2006) to be calibrated and validated in the model. Multiple stations are proposed within the LPRSA, above Dundee Dam, and NBSA in order to capture spatial patterns in contaminant concentrations in the study area. It is anticipated that adequate Group B analyte data will be obtained for the model validation from one high flow event. • The data are intended to provide sufficient temporal (i.e., multiple seasons) coverage to provide an estimate of the contaminant and adsorbent loadings at the model boundaries (i.e., above Dundee Dam, Kill van Kull, Arthur Kill, Hackensack River, Saddle River, Second River, and Third River) during the monitoring events as well as to develop average or time-variable estimates of boundary loadings under current and future conditions.
Where, when, and how should the data be collected/generated?
• The data need to provide spatial coverage of the study area for ecological exposures, and be representative of locations where human exposure is likely to occur based on access, land use, and shoreline characteristics. Data from the sampling locations closest in proximity to an exposure area will be used. Exposure areas are generally described in the PFD (Windward and AECOM 2009). • The data are intended to address temporal variability and provide an estimate of long-term (annual) average concentrations. Direct contact with and ingestion of surface water may occur anytime during the year, although human exposure is anticipated to be greater during the warmer months of the year. Sampling is intended to characterize seasonal variability and provide for estimation of annual average water column concentrations. Sampling is planned to characterize water column concentrations during the seasons of the year when human and biological activities on the river are expected to be greatest (e.g., late spring, summer, early fall). • The data are intended to reflect a variety of flow conditions and tidal stages to characterize the variability in influxes and mixing processes in the study area. At a minimum, low flow, high flow and typical flow events will be captured. • The data are intended to be collected from locations where suspension of solids in the water column is likely to occur under different flow regimes.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- Samples that characterize concentrations in the upper water column are appropriate for evaluating potential human exposures to COPCs during activities such as swimming or wading. This will be achieved by collecting near surface (i.e., from 3 ft below surface) samples at locations in the tidal part of the river and mid-column samples in the shallower non-tidal part of the river.

To meet the desired data needs, three types of sampling events are proposed: Routine Events, Low Flow/Spring Tide Events and High Flow Events. Data from the sampling events will provide some measure of variability and provide the data needed to estimate long term average concentrations. The following describes the events.

The flow thresholds for the low flow and high flow events were selected from an analysis of the discharge record at Dundee Dam (April 2007 to August 2010). The low flow event threshold was identified by conducting an analysis of the number of events satisfying both the discharge criterion and the spring-tide criterion. The analysis showed that a discharge criterion of <400 cfs sustained over the course of at least 7 days was satisfied multiple times (i.e., 8-12 times per calendar years 2007-2009) in each of the years over the period of record at Dundee Dam. Flows of < 400 cfs maintained for 7 consecutive days and predicted to persist through the sampling period will trigger suitable conditions for the Low Flow Event. This will prevent capture of transient substances from any storm events during the period preceding the sampling event.

The high flow threshold was identified by conducting a return frequency analysis using the available discharge data at Dundee Dam. A flow event with a return period of 3 months (or 4 occurrences per year), was chosen as the flow threshold that can reasonably be expected to be exceeded during the CWCM period. Accordingly, the discharge associated with the 1 in 3 months event at Dundee Dam was calculated to be 3,000 cfs and is proposed as the minimum flow for a high flow event. The high flows (exceeding 3,000 cfs) that trigger the High Flow Events are not sustained high flows, but weather-induced flows. The predicted peak discharge of a weather event should exceed the 3,000 cfs criterion to trigger an event. There is no limitation with respect to the duration of the event, but events of such magnitude may occur over the span of several days.

Routine Events (400 - 3,000 cfs at Dundee Dam)

- Five Routine Events are planned under different seasonal conditions (i.e., one in winter, two in spring, and two in summer).
- One Routine Event will target spring tide conditions and one will target neap tide conditions.
- Data collected during these events combined with preliminary partitioning parameters obtained from scientific literature will be used in the preliminary calibration of the diffusive flux rate from the sediments to the water column, and the deposition of particle-bound contaminants from the water column to the sediment.
- Five Routine Events under low- to medium-flow conditions (400 - 3,000 cfs at Dundee Dam) are proposed to capture data representative of the influxes and mixing processes in the river and the bay, the deposition of particulates from the water column to the sediment, and of the diffusive

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

flux of contaminants from the sediments to the water column.

- Samples will be collected at the following 16 locations:

  Above Dundee Dam,

  Saddle River,

  Second River,

  Third River,

  Passaic River at RM 10.2 if flow is > 250 cfs at Dundee Dam or RM 13.5 when flow is < 250 cfs at Dundee Dam,

  Passaic River at RM 0,

  Passaic River at RM 1.4,

  Passaic River at RM 6.7 (or approximately one mile downstream of the toe of the salt wedge if flow is < 1,000 cfs at Dundee Dam),

  Passaic River at RM 4.2 (or halfway between the toe of the salt wedge and RM 1.4 up to RM 4.2 if flow is < 1,000 cfs at Dundee Dam),

  Newark Bay East,

  Newark Bay Northeast,

  Newark Bay Northwest,

  Newark Bay South,

  Kill van Kull,

  Arthur Kill, and

  Hackensack River.

- The locations in Newark Bay South, Hackensack River, Kill van Kull, Arthur Kill, RM 10.2, and RM 1.4 are the same locations occupied in the spring 2010 PWCM program. The location at the toe of the salt wedge will be determined from a lookup table identifying the 2 ppth isohaline location as a function of discharge, tidal range (spring/neap), and tidal cycle (high-/low-tide). See Exhibit 1 of Appendix A (FSP Addendum).

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- Samples will be collected 3 ft below the surface and 3 ft from the bottom of the water column at RM 1.4, RM 10.2, the two locations within the salt wedge in the LPR and at all locations in Newark Bay, Kill van Kull, Arthur Kill, and the Hackensack River in order to characterize concentrations through the water column. At all locations with surface and bottom measurements, the bottom sample will be located 3 ft above the bottom at the thalweg. The proposed depths (3 feet off the bottom and three feet from the surface) were selected to with the goal of sampling the relevant layer while avoiding artifacts associated with sampling in close proximity to the sediment bed, the pycnocline, and the water surface. The freshwater stations (Dundee Dam, Saddle River, Second River, and Third River) will be sampled at mid-depth.
- Samples at RM 1.4, RM 10.2, the two locations within the salt wedge in the LPR and at all locations in Newark Bay, Kill van Kull, Arthur Kill, and the Hackensack River will be collected immediately before high water slack and low water slack, as well as near the maximum velocities of ebb and flood tides to characterize contaminant concentrations throughout the tidal cycle. This frequency will be reviewed and discussed with USEPA following the first two events to determine if sampling just high water slack and low water slack will achieve the PQO. Suspended solids are likely to be higher during maximum flood and ebb velocity and lower during periods of slack tide. Should the concentrations vary by more than 50% between tide stages at any station, this may indicate that intra-tidal variability is a driving factor in overall variability. However, should the differences be less than 50%, it is unlikely that intra-tidal variability will impact the model and the frequency of sampling should be revisited. Samples above Dundee Dam and the LPRSA tributaries will be sampled once per event, independent of tide stage.
- The sampling will be quasi-synoptic. Specifically, sample collection will be conducted within approximately a four-day time frame, and near the same phase of the tide for the tidal locations only. Basic meterological conditions such as wind speed, wind direction and precipitation will be monitored and recorded during each sampling event.

High Flow Events (> 3,000 cfs at Dundee Dam)

- Two sampling events are proposed under storm-induced high flow (i.e., not sustained high flow) conditions (>3,000 cfs at Dundee Dam) in order to capture data under conditions in which resuspension of contaminants from the sediment bed and subsequent deposition from the water column are expected to dominate over other transport processes. Storm events rather than elevated base-flow conditions are expected to be the conditions under which such processes dominate. During elevated base-flows where the discharge is high over an extended period of time, the sediment is expected to be armored allowing for little suspension. The criterion of 3,000 cfs is the flow under which the salt front is anticipated to be below RM 1.4 and is the three-month return period event. As described in Appendix A, the high flow event flow criterion may be relaxed if the flows are not achieved such that storm event data may be collected. USEPA will be consulted should the criterion be revisited.
- Data collected during these events are intended to be used in the preliminary calibration of the resuspension fluxes from the sediments to the water column, and the subsequent deposition of particle-bound contaminants from the water column to the sediment. It is also anticipated that during these events there will be a higher loading of suspended sediments (i.e., more contamination per unit weight of suspended solids, as the

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

suspended solids during a storm event would include more bed sediment). The multiple samples during the course of the hydrograph are intended to provide a better understanding of the changes in suspended solids and its effect on water column concentrations, especially for the

Dundee Dam station. This is intended to permit the development of a rating curve to predict a loading function depending on the hydrograph for the LPR/NB CFT model.

- Samples will be collected at the following 16 locations:
  - Above Dundee Dam,
  - Saddle River,
  - Second River,
  - Third River,
  - RM 10.2,
  - RM 6.7,
  - RM 4.2,
  - RM 1.4,
  - RM 0,
  - Newark Bay East,
  - Newark Bay Northeast,
  - Newark Bay Northwest,
  - Newark Bay South,
  - Kill van Kull,
  - Arthur Kill, and
  - Hackensack River.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- The locations in Newark Bay South, Hackensack, Kill van Kull, Arthur Kill, and RMs 10.2, 6.7, 4.2, and 1.4 are the same locations occupied in the spring 2010 PWCM program.

- Multiple samples are proposed to be collected over the course of the predicted storm hydrograph. As detailed in the FSP (Appendix A), four samples over the predicted storm hydrograph are intended to be collected at most stations. Two samples are proposed for collection on the rising limb on the hydrograph, one near the predicted storm peak, and one on the falling limb of the hydrograph. To capture data on upstream contributions to the LPRSA during storm events, six samples are proposed over the predicted storm hydrograph above Dundee Dam; three on the rising limb, one near predicted peak, and two on the falling limb of the predicted hydrograph. Arthur Kill and Kill van Kull are proposed to be sampled approximately prior to high slack and prior to low slack tide, similar to the Routine Events.
- Above Dundee Dam, the Saddle River, Second River, and Third River stations are proposed to be sampled at mid-depth. The remaining stations will be sampled at both 3 ft below the surface and 3 ft from the bottom of the water column.
- The data are unlikely to be truly synoptic, but the goal will be collect samples throughout the period of the predicted storm hydrograph, somewhat evenly distributed at all locations.

Low Flow/Spring Tide Event (< 400 cfs at Dundee Dam)

- One monitoring event is proposed during low-flow conditions (<400 cfs at Dundee Dam) in combination with a spring tide, since this combination is expected to generate the highest tidal energies and tidal mixing as compared to other flow/tide combinations. The 400 cfs criterion is a discharge during which the salt wedge remains upstream of the Primary Erosion Zone.
- Data collected during the event will be used in the calibration of tidally-driven resuspension processes, potential for upstream transport of contaminants through the salt wedge, and the deposition of particle-bound contaminants from the water column to the sediment.
- Samples will be collected at the following nine locations:
  - Above Dundee Dam,
  - Second River,
  - Third River,
  - Saddle River,

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- RM 0,
- RM 1.4,
- one location approximately 1 mile downstream of the toe of the salt wedge,
- one location halfway between the toe of the salt wedge and RM 1.4, and
- RM 10.2 (for flows >250 cfs) or RM 13.5 (if flows are < 250 cfs).

- The locations at RM 1.4, RM 10.2 (or 13.5), above Dundee Dam, and the LPRSA tributaries are the same locations occupied in the spring 2010 PWCM program. The locations at the toe of the salt wedge are to be determined from a lookup table identifying the 2 ppth isohaline location as a function of discharge, tidal range (spring/neap), and tidal cycle (high-/low-tide) (see Exhibit 1 of Appendix A).
- Samples will be collected 3 ft below the surface and 3 ft above the bottom at all locations in the LPR RM 0-17.4 in order to characterize concentrations through the water column. The bottom sample will be located 3 ft above the bottom at the thalweg. Samples collected above Dundee Dam and in the LPRSA tributaries will be taken mid-depth.
- Four samples will be collected at each location over the tidal cycle – approximately at low water slack, maximum flood velocity, high water slack, and maximum ebb velocity. Samples above Dundee Dam and the LPRSA tributaries will be sampled once per event, independent of tide stage.
- The low flow locations will be sampled quasi-synoptically, within an approximately four day period. Basic meteorological conditions such as wind speed, wind direction and precipitation will be monitored and recorded during each sampling event.

Proposed Monitoring Locations

The locations sampled during each event will provide spatial coverage in the LPRSA for determination of nature and extent of contamination as well as providing data for exposure point concentrations for the RA. Further rationale for the specific sampling locations for each of the above events as they relate to the CFT model is given below:

- Dundee Dam – Provide data to estimate loadings to the model.
- Saddle River – Provide data to estimate loadings to the model.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

- Second River – Provide data to estimate loadings to the model.
- Third River – Provide data to estimate loadings to the model.
- RM 10.2 or RM 13.5 – PWCM deployment location. Provide data for model calibration and validation.
- RM 6.7 - PWCM deployment location. Provide data for model calibration and validation during the High Flow Event.
- RM 4.2 – PWCM deployment location. Provide data for model calibration and validation during the High Flow Event.
- Two locations within the salt wedge as described in Exhibit 1 of Appendix A – Provide data for model calibration and validation during the Routine and Low-flow/Spring-tide Events.
- RM 1.4 –PWCM deployment location. Provide data for model calibration and validation and exchange with Newark Bay.
- RM 0 – Provide data at the boundary of the LPR and Newark Bay for model calibration and validation.
- Newark Bay East – Provide data for model calibration and validation at the eastern shore of Newark Bay in subtidal areas where wind-driven suspension may occur.
- Newark Bay Northeast – Provide data for model calibration and validation at the northern edge of Newark Bay in subtidal areas where wind-driven suspension may occur.
- Newark Bay Northwest – Provide data for model calibration and validation at the western shore of Newark Bay in subtidal areas where wind-driven suspension may occur.
- Newark Bay South – Spring 2010 PWCM deployment location. Provide data for model calibration and validation.
- Hackensack River – Spring 2010 PWCM deployment location. Provide data to estimate loadings/exchange with Newark Bay and for model calibration and validation.
- Kill van Kull – Spring 2010 PWCM deployment location. Provide data to estimate loadings/exchange with Newark Bay and for model calibration and validation.
- Arthur Kill – Spring 2010 PWCM deployment location. Provide data to estimate loadings/exchange with Newark Bay and for model calibration and validation.

The water samples will be collected using a peristaltic pump with dedicated tubing. Refer to Appendix A (FSP Addendum) and Appendix B (Field

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

SOPs) for details of field procedures. To capture the specific tidal stage and flow conditions desired by the CFT model calibration, time on-station will be kept to a minimum (e.g., one hour).
Who will collect and generate the data?
As described in Worksheet #7, AECOM, working on behalf of the CPG, will provide the field sampling coordination and most of the field personnel required to conduct the small volume chemical water column sampling and provide laboratory coordination and support. If necessary, additional field personnel may be provided by de maximis, inc. and/or OSI.
How will the data be reported?
Daily updates of locations and sample collection progress will be communicated as described in Worksheet #6, including communication with the USEPA RPM. Regular reporting on the progress of the CWCM program will be performed as part of the overall monthly progress reporting for the LPRSA RI/FS and will include the following: • Brief summary of any field surveys performed during the previous month (type of survey, dates, number of samples collected, issues of note, and deviations from the program QAPP/FSP Addendum). • Delivery of validated data, processed data, and raw data (as applicable). Requirements for validated data submittals are prescribed by the Region 2 guidance on multimedia electronic data deliverables (EDDs) at [HYPERLINK "http://www.epa.gov/region02/superfund/medd.htm"]. Following completion of the entire CWCM program, a data characterization summary report will be prepared that will include the following: • Summary of the overall monitoring effort including a full description of any deviations from the QAPP/FSP Addendum • Presentation of a data quality review and summary of data usability • Summary graphics of monitoring data from the LPRSA and NBSA • Discussion on achievement of the PQOs and any recommended follow-up investigations
How will the data be archived?

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

The data will be managed daily and archived per the AECOM DMP (AECOM 2010b) (see Worksheet #29). Electronic data will be archived by ddms.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	VOCs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-1, C-2	Accuracy/Bias-Contamination	No target compound >Quantitation Limit (QL), no common lab contaminants >5x QL	Method Blank (MB)/Instrument Blank	A
	C-1, C-2	Accuracy/Bias-Contamination	No target compound >QL, no common lab contaminants >5x QL	Trip Blank/Equipment Rinsate Blank	S & A
	C-1, C-2	Accuracy/Bias	Compound-specific percent recoveries (%Rs), see Appendix C-2	Laboratory Control Sample (LCS)	A
	C-1, C-2	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	Matrix Spike (MS)	S & A
	C-1, C-2	Accuracy/Bias	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68-117%R Dibromofluoromethane: 73-122%R Toluene-d8: 78-129%R	Surrogates	A
	C-1, C-2	Accuracy/Bias	Supplier Certified Limits	Performance Evaluation (PE) Sample	A
	C-1, C-2	Precision	Compound-specific relative percent difference (RPD), see Appendix C-2	Matrix Spike Duplicate (MSD)	S & A
	C-1, C-2	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL.	Field Duplicate	S & A
	C-1, C-2	Completeness (Laboratory Analyses)	≥ 90%	Data Completeness Check	S & A

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	SVOCs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-2, T-7	Accuracy/Bias-Contamination	No target compound >QL, no common lab contaminants >5x QL	MB/Instrument Blank	A
	T-2, T-7	Accuracy/Bias-Contamination	No target compound >QL, no common lab contaminants >5x QL	Equipment Rinsate Blank	S & A
	T-2, T-7	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	LCS	A
	T-2, T-7	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	MS	S & A
	T-2, T-7	Accuracy/Bias	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R	Surrogates	A
	T-2, T-7	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	T-2, T-7	Precision	Compound-specific RPD, see Appendix C-2	MSD	S & A
	T-2, T-7	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-2, T-7	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PAHs and Alkyl PAHs (Low Resolution Mass Spectrometry [LRMS] – SIM)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-4, T-3	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	T-4, T-3	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	T-4, T-3	Accuracy/Bias	60-140%R	LCS	A
	T-4, T-3	Accuracy/Bias	60-140%R	MS	S & A
	T-4, T-3	Precision	RPD<30%	MSD	S & A
	T-4, T-3	Accuracy/Bias	60-140%R in MB and LCS 30-120%R in field samples	Labeled compounds	A
	T-4, T-3	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	T-4, T-3	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-4, T-3	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	OC Pesticides				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-11	Accuracy/Bias - Contamination	No target compound >QL	MB/Instrument Blank	A
	T-11	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	T-11	Accuracy/Bias	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%;	On-going Precision and Recovery (OPR) sample (equivalent to LCS sample)	A
	T-11	Accuracy/Bias	50-150%R	MS	S & A
	T-11	Precision	RPD<30%	MSD	S & A
	T-11	Accuracy/Bias	Per EPA 1699 Table 5	Labeled compounds	A
	T-11	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or QCCS Sample Analysis[d]	A
	T-11	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-11	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

[d] Refer to Worksheet#31 for additional details of the program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCBs – Congeners and Homologs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	T-6, T-5	Accuracy/Bias-Contamination	No target compound > QL	MB/Instrument Blank	A
	T-6, T-5	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	T-6, T-5	Accuracy/Bias	50-150%R Toxics/Level of Chlorination (LOC) congeners 40-160%R all other congeners	OPR sample (equivalent to LCS)	A
	T-6, T-5	Accuracy/Bias	50-150%R Toxics/LOC congeners 40-160%R all other congeners	MS	S & A
	T-6, T-5	Precision	RPD <30%	MSD	S & A
	T-6, T-5	Accuracy/Bias	30-140%R	Labeled compounds	A
	T-6, T-5	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or QCCS Sample Analysis[d]	A
	T-6, T-5	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	T-6, T-5	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	PCDD/PCDFs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	A-1	Accuracy/Bias-Contamination	No target compound >QL	MB/Instrument Blank	A
	A-1	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	A-1	Accuracy/Bias	%D for RRF vs ICAL ≤ 20% except labeled analogs ≤ 30%	Batch control spike (BCS_3)[d]	A
	A-1	Accuracy/Bias	50-150%R	MS	S & A
	A-1	Precision	RPD ≤25%	MSD	S & A
	A-1	Accuracy/Bias	Compound-specific %Rs, see SOP	Labeled Compounds	A
	A-1	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or QCCS Sample Analysis[e]	A
	A-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	A-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] The BCS_3 is a special QC sample prepared with each 20 sample batch that combines all the spike solutions used on field samples with target analytes. It is analyzed at the beginning and end of each analytical sequence containing the associated samples.
[e] Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Metals (total and dissolved) by Inductively Coupled Plasma/ Atomic Emission Spectroscopy (ICP/AES)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-4, C-3	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-4, C-3	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-4, C-3	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	LCS	A
	C-4, C-3	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	MS	S & A
	C-4, C-3	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-4, C-3	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-4, C-3	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-4, C-3	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Metals (total and dissolved) by Inductively Coupled Plasma – Mass Spectrometry (ICP/MS)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-3, C-5, C-6	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-3, C-5, C-6	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-3, C-5, C-6	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	LCS	A
	C-3, C-5, C-6	Accuracy/Bias	Compound-specific %Rs, see Appendix C-2	MS	S & A
	C-3, C-5, C-6	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-3, C-5, C-6	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-3, C-5, C-6	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-3, C-5, C-6	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Mercury (Low Level, total and dissolved)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	B-1	Accuracy/Bias-Contamination	Average MB <2x Method Detection Limit (MDL) and standard deviation <0.67x MDL or <0.1x the concentration of project samples	MB	A
	B-1	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	B-1	Accuracy/Bias	80 -120%R	LCS	A
	B-1	Accuracy/Bias	71 -125%R	MS	S & A
	B-1	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	B-1	Precision	RPD ≤24%	MSD	S & A
	B-1	Precision	RPD ≤24%	Laboratory Duplicate	A
	B-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	B-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Methyl Mercury (total and dissolved)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	B-2	Accuracy/Bias-Contamination	Average MB <0.045 nanograms per liter (ng/L) and standard deviation ≤0.015 ng/L or <0.1x the concentration of project samples	MB	A
	B-2	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	B-2	Accuracy/Bias	65-135%R	MS	S & A
	B-2	Precision	RPD ≤35%	MSD	S & A
	B-2	Precision	RPD ≤35% (or ± QL if results are ≤5x the QL)	Laboratory Duplicate	A
	B-2	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	B-2	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Hexavalent Chromium (dissolved)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-15	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-15	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-15	Accuracy/Bias	90-110%R	LCS	A
	C-15	Accuracy/Bias	90-110%R	MS	S & A
	C-15	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-15	Precision	RPD ≤20%	MSD	S & A
	C-15	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-15	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-15	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Butyltins				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-8, C-7	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-8, C-7	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-8, C-7	Accuracy/Bias	Tripropyltin: 24-142%R	Surrogate	A
	C-8, C-7	Accuracy/Bias	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R	LCS	A
	C-8, C-7	Accuracy/Bias	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R	MS	S & A
	C-8, C-7	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-8, C-7	Precision	RPD ≤30%	MSD	S & A
	C-8, C-7	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-8, C-7	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry - Sulfide				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-14	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-14	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-14	Accuracy/Bias	74-122%R	LCS	A
	C-14	Accuracy/Bias	74-122%R	MS	S & A
	C-14	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-14	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-14	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-14	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – TDS				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-19	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-19	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-19	Accuracy/Bias	85-115%R	LCS	A
	C-19	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-19	Precision	RPD ≤10%	Laboratory Duplicate	A
	C-19	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-19	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Ammonia-N				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-9	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-9	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-9	Accuracy/Bias	90-112%R	LCS	A
	C-9	Accuracy/Bias	90-112%R	MS	S & A
	C-9	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-9	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-9	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-9	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Cyanide				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-10	Accuracy/Bias-Contamination	No detection >QL	MB	A
	C-10	Accuracy/Bias-Contamination	No detection >QL	Equipment Rinsate Blank	S & A
	C-10	Accuracy/Bias	83 – 116%R	LCS	A
	C-10	Accuracy/Bias	35 -144%R	MS	S & A
	C-10	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-10	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-10	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-10	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – TKN				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-12	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-12	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-12	Accuracy/Bias	78-117%R	LCS	A
	C-12	Accuracy/Bias	37-158%R	MS	S & A
	C-12	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-12	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-12	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-12	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheets #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Total Phosphorus				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-11	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-11	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-11	Accuracy/Bias	88- 113%R	LCS	A
	C-11	Accuracy/Bias	50 -144%R	MS	S & A
	C-11	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-11	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-11	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-11	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry –TOC and DOC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-13, C-16	Accuracy/Bias-Contamination	<Practical Quantitation Limit (PQL)	MB	A
	C-13, C-16	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-13, C-16	Accuracy/Bias	90-109%R	LCS	A
	C-13, C-16	Precision	RPD≤ 20%	LCS Duplicate (LCSD)	A
	C-13, C-16	Accuracy/Bias	≤110% of the unspiked sample	Inorganic Carbon Spike	A
	C-13, C-16	Accuracy/Bias	80-120%R	MS	A
	C-13, C-16	Precision	RPD≤ 20%	MSD	A
	C-13, C-16	Accuracy/Bias	Supplier C ertified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-13, C-16	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-13, C-16	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – POC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-16	Accuracy/Bias-Contamination	<0.025 mg/L or <10% of the concentration in the associated samples	MB	A
	C-16	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-16	Accuracy/Bias	95-105%R or within the manufacturer's control limits	LCS	A
	C-16	Accuracy/Bias	85-115%R	Laboratory Fortified Blank (LFB)	A
	C-16	Precision	RPD ≤20% if both samples are >10x QL	Laboratory Duplicate	A
	C-16	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-16	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Suspended Sediment Concentration (SSC)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-17	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-17	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-17	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-17	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-17	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Alkalinity				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-20	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-20	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-20	Accuracy/Bias	94-106%R	LCS	A
	C-20	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-20	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-20	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-20	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Sulfate and Chloride				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-21	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-21	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-21	Accuracy/Bias	90-110%R	LCS	A
	C-21	Accuracy/Bias	80-120%R	MS	S & A
	C-21	Accuracy/Bias	Supplier Certified Limits	PE Sample Data Review or Sample Analysis[d]	A
	C-21	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-21	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-21	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	General Chemistry – Chlorophyll a				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	C-22	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-22	Accuracy/Bias-Contamination	No target compound >QL	Filtration Blanks	A
	C-22	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S & A
	C-22	Accuracy/Bias	91-108%R	LCS	A
	C-22	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	C-22	Precision	RPD ≤20%	Laboratory Duplicate	A
	C-22	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	S & A
	C-22	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet#31 for additional details of the PE program.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Bacteria – Total coliform and *Escherichia coli* (*E. Coli*)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	E-1	Accuracy/Bias	Yellow color (coliform) with fluorescence (*E.coli*)	Control Sample	A
	E-1	Accuracy/Bias-Contamination	No color, no fluorescence	MB	A
	E-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	A
	E-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Microbiological – Fecal coliform				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	E-2	Accuracy/Bias	Blue colored colonies	Control Sample	A
	E-2	Accuracy/Bias-Contamination	No blue colored colonies	MB	A
	E-2	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	A
	E-2	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Microbiological – Fecal Streptococci and Fecal Enterococci				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	E-3, E-4	Accuracy/Bias	Pink-red colored colonies	Control Sample	A
	E-3, E-4	Accuracy/Bias-Contamination	No pink-red colored colonies	MB	A
	E-3, E-4	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	A
	E-3, E-4	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Microbiological – Protozoans (Cryptosporidium)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	S-1	Accuracy/Bias-Contamination	No detected oocysts	MB	A
	S-1	Accuracy/Bias	11-100%R	Control Sample	A
	S-1	Accuracy/Bias	13-111%R	MS	A
	S-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	A
	S-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Water				
Analytical Group[a]	Microbiological – Protozoans (*Giardia*)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQI**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-FI-04	S-1	Precision	RPD ≤30%	Laboratory Duplicates	S&A
	S-1	Accuracy/Bias-Contamination	No detected cysts	MB	A
	S-1	Accuracy/Bias	14-100%R	LCS	A
	S-1	Accuracy/Bias	14-118%R	MS	A
	S-1	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Field Duplicate	A
	S-1	Completeness (Laboratory Analyses)	≥90%	Data Completeness Check	S & A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Work Performed by Tierra Solutions, Inc. in LPRSA				
Tide Gage Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., Water level fluctuations, April 14, 1995 to June 11, 1996 (partial), 3 gages RM: 0.9–7.8	Provides characterization of water level variation.	Does not cover all flow conditions. Covers only RM 0.9 – 7.8. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Current Cross-Section Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., 8 Velocity cross-sections periodically surveyed between July 7, 1995 and May 22, 1996 during different tide phases RM: 0.5–7.9	Provides characterization under limited set of conditions.	Does not cover all flow conditions. Covers only RM 0.5 – 7.9. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Current Profile Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., Point velocity meters, July 26, 1995 to May 22, 1996 (partial), 3 gages RM: 1.4–6.8	Provides characterization under limited set of conditions.	Does not cover all flow conditions. Covers only RM 1.4 – 6.8. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Salinity Cross-Section Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., 8 Salinity cross-sections periodically surveyed between July 20, 1995 and May 22, 1996, during different tide phases RM: 0.5–7.9	Provides characterization under limited set of conditions.	Does not capture movement of salt wedge with flow conditions. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Work Performed by MPI in LPRSA				
Moored Current Profile Measurement	MPI 2004 to 2005 No Formal Report [HYPERLINK "http://www.ourpassaic.org"] Accessed January 20, 2008.	MPI, Vertical velocity profile, November 2, 2004, to October 11, 2005 (partial), 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Dataset is incomplete with substantial time periods and spatial locations not included. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Salinity Measurement	MPI 2004 to 2005 No Formal Report [HYPERLINK "http://www.ourpassaic.org"] Accessed January 20, 2008.	MPI, surface and bottom salinity conditions, November 30, 2004 to September 20, 2005, 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Meters present only between RM 8.6 and RM 11.5. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Turbidity Measurement	MPI 2004 to 2005 No Formal Report [HYPERLINK "http://www.ourpassaic.org"] Accessed January 20, 2008.	MPI, surface and bottom suspended solids conditions, November 30, 2004 to September 20, 2005 (partial), 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Meters present only between RM 8.6 and RM 11.5. See PWCM QAPP (AECOM 2010a) for data quality review.
Dissolved/total metals, Dissolved/particulate PCBs, pesticides, POC, DOC, Chlorine (Cl), Bromine (Br), Total Suspended Solids (TSS)	MPI, pilot dredging study Passaic River Estuary Management Information System (PREmis) database	Collected December 2005 in Harrison Reach only.	Provides characterization under limited set of conditions.	Very limited temporal or spatial coverage or limited/lacking corresponding hydrodynamic information.
PCDD/PCDFs, pesticides, PCBs, TSS	MPI, HOC Sampling Method Validation Study (HSMVS) survey project PREmis database	Collected October/November 2005	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology.	Limited temporal and spatial coverage.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Metals, pesticides, VOCs, SVOCs, herbicides, nutrients, Biological Oxygen Demand (BOD), DOC, Chlorophyll a , TSS	MPI Small Volume Composite Grab (SVCG) survey project PREmis database	Collected November 2005	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology.	Limited temporal and spatial coverage.
Empirical Mass Balance Model (EMBM) Sampling Program - Water Column Suspended Sediment Sampling on Tributaries and Upper Passaic River	PREmis database	Collected Winter 2008	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology	Limited temporal and spatial coverage. No report available providing methodology.
Work Performed by Rutgers University Coastal Ocean Observation Lab in LPRSA and/or NBSA				
Moored Salinity Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, surface and bottom salinity, August 18, 2004 to September 12, 2005, 5 moorings RM: 1.0–7.8	Provides characterization under limited set of conditions	Does not cover all flow conditions. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Current Profile Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, Vertical velocity profile, August 18, 2004 to September 3, 2005 RM: 2.8	Provides insight to appropriate mooring locations for future synoptic data	Available for single location at approximately RM 3. See PWCM QAPP (AECOM 2010a) for data quality review.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Salinity Profile Transect Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, 13 Salinity transects, June 23, 2004 to August 18, 2005. RM: 0.0–8.0	Provides characterization under limited set of conditions	Covers only lower 8 miles of river. Synoptic nature of data unconfirmed. See PWCM QAPP (AECOM 2010a) for data quality review.
Current Profile Transect Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, Velocity cross-section, September 23, 2004 to August 18, 2005, 13 transects RM: 0.0–8.0	Will not be used	Data not corrected for magnetic influence on instrumentation compass, or used to monitor dye study, therefore not synoptic. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Turbidity Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, surface and bottom suspended solids conditions, August 18, 2004 to September 12, 2005 (partial), 5 moorings RM: 1.0–6.7	Will not be used	Substantial instrumentation fouling due to debris in river. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Turbidity Measurement	Rutgers 2004 to 2005 No Formal Report [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] Accessed January 20, 2008	Rutgers, Vertical turbidity profile, August 18, 2004 – September 3, 2005 RM: 2.8	Provides characterization under limited set of conditions	Data available only for RM 3. See PWCM QAPP (AECOM 2010a) for data quality review.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Moored Acoustic Doppler Current Profiler (ADCP) Measurements	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Covers a range of flow events, but the complete set of concurrent turbidity data (for estimating loads into and out of the system) was not recovered.
Moored Turbidity Measurements	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Surface turbidity data in the Kills was corrected due to fouling, limiting the ability to use the data in model development.
Water Column TSS	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. Collected along transects at the locations of the 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Data will be reviewed for quality, completeness and sufficiency for NBSA characterization when publically available
Work performed by various investigators in LPRSA and/or NBSA				
Stream Flow	United States Geological Service (USGS) Gage 01389500 – Passaic River at Little Falls, NJ No Formal Report [HYPERLINK "http://waterdata.usgs.gov/nj/nwis/nwisman/?site_no=01389500&agency_cd=USGS"]	USGS Daily average stream flow August 1897 – present	Record of historical flows, development of flow frequency statistics, and evaluation of other water column measurements	No limitations

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Stream Flow	USGS Gage 01389890 – Passaic River at Dundee Dam at Clifton, NJ No Formal Report [HYPERLINK "http://waterdata.usgs.gov/nj/nwis/inventory/?site_no=01389890&amp"]	USGS Daily average stream flow April 2007 – present	Evaluation of other water column measurements, compare with Little Falls data	Limited record
Various Water Quality Parameters	Tierra Solutions, Inc. (2004) for a complete summary of historic data collection programs	Various public and private entities	Data provides historic context, but no direct application.	Limited spatial and temporal extent, potentially dated laboratory methods, many studies not performed to CERCLA standards.
HOCs, Metals, carbon, TSS and ancillary (loading) data	NY/NJ HEP Contamination Assessment Reduction Project (CARP) program. See NY/NJ HEP website [HYPERLINK "http://www.carpweb.org/main.html"].	Same as data source	May use NY/NJ HEP data for comparative purposes	Very limited temporal or spatial coverage or limited/lacking corresponding hydrodynamic information

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Sampling Tasks: Refer to FSP Addendum (Appendix A)

The proposed investigation for the small volume phase of the RI CWCM Data Collection includes collection of water samples from the LPRSA (including the three major LPRSA tributaries), above Dundee Dam, and the NBSA (Newark Bay and its confluences with Arthur Kill, Kill van Kull and Hackensack River). Eight sampling events that cover a variety of LPRSA flow conditions and tidal stages are proposed. Seven sampling events will include sampling a variety of flow conditions and tidal stages in the NBSA. Samples will be collected from the water column at each station using a peristaltic pump and tubing. Samples collected from freshwater areas including above Dundee Dam and the three LPRSA tributaries will be collected from mid-depth in the water column. At all other stations, including where the salt wedge is typically or always present, samples will be collected from two depths: 3 ft above bottom and 3 ft below the surface. The depth will be measured using a graduated line, depth gage and the vessel fathometer. Locations are presented in Worksheet #18 and Appendix A (Figure 1 and Exhibit 1).

At each location, water will be collected for analysis of target analytes divided into four analytical groups that includes, at a subset of stations, analysis of biological pathogens (see Worksheet #18). Water samples will be whole, unfiltered water, except for the samples collected for the dissolved phase concentrations of a subset of metals. Filtration for these metals will be conducted in the field due to short holding times associated with unpreserved samples. As indicated in SOP LPR-FI-06, “clean hands/dirty hands” techniques will be used to sample and filter the metals samples, including mercury and methyl mercury.

Three types of sampling events are planned for the small volume sampling program: Routine, Low Flow/Spring Tide and High Flow Events. These events have been planned to provide a variety of conditions for calibration and validation of the CFT model, as well as temporal variability (i.e., multiple seasons) for the RAs and FWM. The locations selected for the program provide both spatial coverage of the LPRSA and NBSA, and in some instances are located such that they reflect specific conditions relative to the location of the salt wedge during different flow regimes. This information will allow calibration and validation of the CFT model.

Analysis Tasks: As the initial phase of the overall RI/FS chemical water column characterization, this investigation will include a wide range of analyses. Four groups of analyses are proposed:

Group A - A list of target physical and inorganic and organic chemical analyses is proposed for the full set of stations and depths (refer to Worksheet #15). These analytes will be measured in all samples during each of the eight events and will be used primarily for estimation of EPCs for the HHRA, ERA and FWM, and in the CFT model calibration. This analyte list is consistent with the Modeling Work Plan (HydroQual, 2006) and include PCDD/PCDFs, PCB congeners and homologs, mercury (total and dissolved), and supporting parameters to be used in the CFT model (i.e., DOC, POC, SSC, TOC, chlorophyll a, alkalinity, sulfate, total sulfide, TDS, and chloride). Total and dissolved cadmium, copper and lead will also be included in the Group A analyte list.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Group B - A comprehensive list of physical and inorganic and organic chemical analyses is proposed for the full set of stations and depths for a subset of sampling events (refer to Worksheet #15). These parameters will be used to support EPC calculations for the HHRA, ERA and FWM, as well as validation of the CFT model and include TCL SVOCs, TCL VOCs, TAL metals, a subset of TAL metals in dissolved phase (arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc), titanium, methyl mercury (total and dissolved), hexavalent chromium (dissolved only), butyltins, OC pesticides, cyanide, PAHs, alkyl PAHs, hardness (calculated), TKN, ammonia and total phosphorus.

Group C - Pathogen analyses are proposed for near-surface samples from five stations in RM 0 - 17.4 of the LPR to determine their relevance in future investigation phases. The five stations, shown in Worksheet #18, were selected by reviewing the sample maps to ensure coverage within the full length of the river, with a focus on areas of where CSOs are present and to provide information regarding the input of pathogens during storm events from off-site sources. Group C will be sampled during spring and summer routine events, the low flow/spring tide event, and both high flow events and includes total coliform and *E. coli*, fecal coliform, fecal streptococci and fecal enterococci bacteria.

Group D - Additional pathogen analyses are proposed for near-surface samples from five stations in RM 0 - 17.4 of the LPR to determine their relevance in future investigation phases. Group D includes the protozoans *Giardia* and cryptosporidium and will be sampled during summer routine events and both high flow events.

Specific stations designated for the additional Group C and D analyses are noted in Worksheet #18

Field measurements will include continuous surface to near-bottom measurements of dissolved oxygen, pH, specific conductivity, temperature, and salinity. Physical, chemical, and biological/pathogen tests will be performed on the water samples at the fixed laboratories identified in Worksheet #30 according to methods listed in Worksheet #23.

Quality Control Tasks: QC samples have been defined for the field and laboratory efforts. Field QC samples are summarized on Worksheet #20; laboratory QC samples are summarized on Worksheet #28.

Secondary Data: All relevant secondary/historical data are summarized on Worksheet #13.

Data Management Tasks: AECOM's DMP (AECOM 2010c) covers all field-collected and laboratory-generated records/data. The handling of records and data are summarized on Worksheet #29.

Documentation and Records: Project related records (field, sample transfer/chain of custody, laboratory) are summarized on Worksheet #29.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Assessment/Audit Tasks: Field and laboratory audits are scheduled in accordance with Worksheet #31.

Data Review Tasks: Field data will be reviewed as described in Worksheet #34. Laboratories are contractually required to verify all laboratory data including EDDs as summarized in Worksheet #34. Data validation and usability assessments will be conducted as detailed in Worksheets #35, 36, and 37.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TCL VOCs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
1,1,1-Trichloroethane	71556	11	ug/L	[11]	0.5	NA	5	0.08	0.5
1,1,2,2-Tetrachloroethane	79345	0.067	ug/L	[6]	0.5	NA	5	**0.16**	**0.5**
1,2,2-Trichloro-1,1,2-trifluoroethane	76131	5900	ug/L	[6]	0.5	NA	5	0.13	0.5
1,1,2-Trichloroethane	79005	0.042	ug/L	[6]	0.5	NA	5	**0.14**	**0.5**
1,1-Dichloroethene	75354	4.7	ug/L	[1]	0.5	NA	5	0.077	0.5
1,1-Dichloroethane	75343	2.4	ug/L	[6]	0.5	NA	5	0.074	0.5
1,2,3-Trichlorobenzene	87616	2.9	ug/L	[6]	2	NA	5	0.11	2
1,2,4-Trichlorobenzene	120821	0.41	ug/L	[6]	2	NA	5	0.096	**2**
1,2-Dibromoethane	106934	0.0065	ug/L	[6]	2	NA	5	**0.2**	**2**
1,2-Dibromo-3-chloropropane	96128	0.00032	ug/L	[6]	2	NA	5	**0.1**	**2**
1,2-Dichlorobenzene	95501	14	ug/L	[11]	0.5	NA	5	0.12	0.5
1,2-Dichloroethane	107062	0.15	ug/L	[6]	0.5	NA	5	0.08	**0.5**
1,2-Dichloropropane	78875	0.39	ug/L	[6]	0.5	NA	5	0.095	**0.5**
1,3-Dichlorobenzene	541731	37	ug/L	[6]	0.5	NA	5	0.1	0.5
1,4-Dichlorobenzene	106467	0.43	ug/L	[6]	0.5	NA	5	0.12	**0.5**
2-Butanone	78933	710	ug/L	[6]	20	NA	5	1.9	20
2-Hexanone	591786	4.7	ug/L	[6]	20	NA	5	2.7	**20**
4-Methyl-2-pentanone	108101	170	ug/L	[11]	20	NA	5	2.6	20
Acetone	67641	1500	ug/L	[11]	20	NA	5	3.3	20
Benzene	71432	0.15	ug/L	[1]	0.5	NA	5	0.054	**0.5**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
Bromochloromethane	74975	0.55	ug/L	[1][3]	0.5	NA	5	0.16	0.5
Bromodichloromethane	75274	0.12	ug/L	[6]	0.5	NA	5	0.091	**0.5**
Bromoform	75252	4.3	ug/L	[1][3]	0.5	NA	5	0.16	0.5
Bromomethane	74839	0.87	ug/L	[6]	0.5	NA	5	0.09	0.5
Carbon disulfide	75150	0.92	ug/L	[11]	0.5	NA	5	0.055	0.5
Carbon tetrachloride	56235	0.23	ug/L	[3]	0.5	NA	5	0.096	**0.5**
Chlorobenzene	108907	9.1	ug/L	[6]	0.5	NA	5	0.11	0.5
Chloroethane	75003	2100	ug/L	[6]	0.5	NA	5	0.16	0.5
Chloroform	67663	0.19	ug/L	[6]	0.5	NA	5	0.072	**0.5**
Chloromethane	74873	19	ug/L	[6]	0.5	NA	5	0.068	0.5
cis-1,2-Dichloroethene	156592	7.3	ug/L	[6]	0.5	NA	5	0.067	0.5
cis-1,3-Dichloropropene	10061015	0.34	ug/L	[1][3]	0.5	NA	5	0.18	**0.5**
Cyclohexane	110827	1300	ug/L	[6]	1	NA	5	0.1	1
Dibromochloromethane	124481	0.15	ug/L	[6]	0.5	NA	5	0.14	**0.5**
Dichorodifluoromethane	75718	20	ug/L	[6]	0.5	NA	5	0.13	0.5
Ethylbenzene	100414	1.5	ug/L	[6]	0.5	NA	5	0.05	0.5
Isopropylbenzene	98828	68	ug/L	[6]	2	NA	5	0.051	2
Methyl acetate	79209	3700	ug/L	[6]	1	NA	5	0.15	1
Methyl tert-Butyl Ether	1634044	12	ug/L	[6]	0.5	NA	5	0.11	0.5
Methylcyclohexane	108872	NA	ug/L	NA	1	NA	5	0.086	1
Methylene chloride	75092	2.5	ug/L	[1]	2	NA	5	0.1	2
Styrene	100425	100	ug/L	[5]	0.5	NA	5	0.089	0.5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
Tetrachloroethene	127184	0.11	ug/L	[6]	0.5	NA	5	0.099	**0.5**
Toluene	108883	9.8	ug/L	[11]	0.5	NA	5	0.052	0.5
trans-1,2-Dichloroethene	156605	11	ug/L	[6]	0.5	NA	5	0.057	0.5
trans-1,3-Dichloropropene	10061026	0.34	ug/L	[1][3]	0.5	NA	5	0.068	**0.5**
Trichloroethene	79016	1	ug/L	[1]	0.5	NA	5	0.1	0.5
Trichlorofluoromethane	75694	130	ug/L	[6]	0.5	NA	5	0.12	0.5
Vinyl chloride	75014	0.016	ug/L	[6]	0.5	NA	5	**0.075**	**0.5**
Xylenes (total)	1330207	1.8	ug/L	[11]	0.5	NA	5	0.09	0.5
Tentatively Identified Compounds	NA	NA	ug/L	NA	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TCL SVOCs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
1,1'-Biphenyl	92524	0.083	ug/L	[6]	1	NA	10	0.04	**1**
1,2,4,5-Tetrachlorobenzene	95943	0.97	ug/L	[1][3]	1	NA	10	0.07	**1**
1,4-Dioxane by modified EPA Method 8270 SIM	123911	0.67	ug/L	[6]	0.2	NA	10	0.14	**2**
2,3,4,6-Tetrachlorophenol	58902	110	ug/L	[6]	1	NA	10	0.14	1
2,4,5-Trichlorophenol	95954	370	ug/L	[6]	1	NA	10	0.15	1
2,4,6-Trichlorophenol	88062	0.58	ug/L	[1]	1	NA	10	0.18	**1**
2,4-Dichlorophenol	120832	11	ug/L	[6]	0.2	NA	10	0.03	0.2
2,4-Dimethylphenol	105679	73	ug/L	[6]	1	NA	10	0.09	1
2,4-Dinitrophenol	51285	7.3	ug/L	[6]	5	NA	50	0.61	5
2,4-Dinitrotoluene	121142	0.11	ug/L	[1][3]	1	NA	10	0.05	**1**
2,6-Dinitrotoluene	606202	3.7	ug/L	[6]	1	NA	10	0.08	1
2-Chloronaphthalene	91587	290	ug/L	[6]	0.2	NA	10	0.02	0.2
2-Chlorophenol	95578	18	ug/L	[6]	1	NA	10	0.17	1
2-Methylnaphthalene	91576	15	ug/L	[6]	0.2	NA	10	0.01	0.2
2-Methylphenol	95487	13	ug/L	[11]	1	NA	10	0.09	1
2-Nitroaniline	88744	37	ug/L	[6]	5	NA	50	0.35	5
2-Nitrophenol	88755	1100	ug/L	[6]	1	NA	10	0.17	1
3,3',-Dichlorobenzidine	91941	0.021	ug/L	[1][3]	1	NA	20	**0.11**	**1**
3-Nitroaniline	99092	37	ug/L	[6]	5	NA	50	0.32	5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
4,6-Dinitro-2-methylphenol	534521	0.29	ug/L	[6]	5	NA	50	0.22	**5**
4-Bromophenyl phenylether	101553	NA	ug/L	NA	1	NA	10	0.06	1
4-Chloro-3-methylphenol	59507	370	ug/L	[6]	1	NA	10	0.08	1
4-Chloroaniline	106478	0.34	ug/L	[6]	1	NA	20	0.09	**1**
4-Chlorophenyl phenylether	7005723	NA	ug/L	NA	1	NA	10	0.05	1
4-Methylphenol	106445	18	ug/L	[6]	1	NA	10	0.09	1
4-Nitroaniline	100016	3.4	ug/L	[6]	5	NA	50	0.02	**5**
4-Nitrophenol	100027	300	ug/L	[11]	5	NA	50	0.17	5
Acenaphthene	83329	220	ug/L	[6]	0.2	NA	10	0.01	0.2
Acenaphthylene	208968	220	ug/L	[6]	0.2	NA	10	0.02	0.2
Acetophenone	98862	370	ug/L	[6]	1	NA	10	0.08	1
Anthracene	120127	0.73	ug/L	[11]	0.2	NA	10	0.02	0.2
Atrazine	1912249	0.29	ug/L	[6]	1	NA	10	0.09	**1**
Benzaldehyde	100527	370	ug/L	[6]	1	NA	10	0.15	1
Benzo(g,h,i)perylene	191242	110	ug/L	[6]	0.2	NA	10	0.02	0.2
Benzo(a)pyrene	50328	0.0029	ug/L	[6]	0.2	NA	10	**0.01**	**0.2**
Benzo(a)anthracene	56553	0.0038	ug/L	[3]	0.2	NA	10	**0.01**	**0.2**
Benzo(b)fluoranthene	205992	0.0038	ug/L	[3]	0.2	NA	10	**0.02**	**0.2**
Benzo(k)fluoranthene	207089	0.0038	ug/L	[3]	0.2	NA	10	**0.05**	**0.2**
bis-(2-Chloroethoxy) methane	111911	11	ug/L	[6]	1	NA	10	0.06	1
bis-(2-Chloroethyl)ether	111444	0.012	ug/L	[6]	0.2	NA	10	**0.03**	**0.2**
2,2'-Oxybis (1-chloropropane)	108601	0.32	ug/L	[6]	0.2	NA	10	0.02	0.2

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
bis(2-Ethylhexyl)phthalate	117817	1.2	ug/L	[1][3]	0.2	NA	10	0.80	0.2
Butylbenzylphthalate	85687	19	ug/L	[11]	1	NA	10	0.14	1
Caprolactam	105602	1800	ug/L	[6]	1	NA	10	1.19	1
Carbazole	86748	NA	ug/L	NA	5	NA	10	0.02	5
Chrysene	218019	0.0038	ug/L	[3]	0.2	NA	10	**0.01**	**0.2**
Dibenzo(a,h)anthracene	53703	0.0029	ug/L	[6]	0.2	NA	10	**0.02**	**0.2**
Dibenzofuran	132649	3.7	ug/L	[6]	1	NA	10	0.06	1
Diethylphthalate	84662	210	ug/L	[11]	1	NA	10	0.15	1
Dimethylphthalate	131113	270000	ug/L	[3]	1	NA	10	0.08	1
Di-n-Butylphthalate	84742	35	ug/L	[11]	1	NA	10	0.13	1
Di-n-octylphthalate	117840	NA	ug/L	NA	1	NA	10	0.21	1
Fluoranthene	206440	130	ug/L	[1][3]	0.2	NA	10	0.02	0.2
Fluorene	86737	3.9	ug/L	[11]	0.2	NA	10	0.02	0.2
Hexachlorobenzene	118741	0.00028	ug/L	[1][3]	0.2	NA	10	**0.02**	**0.2**
Hexachlorobutadiene	87683	0.44	ug/L	[1][3]	0.2	NA	10	0.02	0.2
Hexchlorocyclopentadiene	77474	22	ug/L	[6]	1	NA	10	0.05	1
Hexachloroethane	67721	1.4	ug/L	[1][3]	1	NA	10	0.06	1
Indeno(1,2,3-cd)pyrene	193395	0.0038	ug/L	[3]	0.2	NA	10	**0.02**	**0.2**
Isophorone	78591	35	ug/L	[1][3]	1	NA	10	0.06	1
Naphthalene	91203	0.14	ug/L	[6]	0.2	NA	10	0.01	**0.2**
Nitrobenzene	98953	0.12	ug/L	[6]	0.2	NA	10	0.08	**0.2**
N-Nitrosodi-n-propylamine	621647	0.005	ug/L	[1][3]	0.2	NA	10	**0.03**	**0.2**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
n-Nitrosodiphenylamine	86306	3.3	ug/L	[1][3]	0.2	NA	10	0.09	0.2
Pentachlorophenol	87865	0.17	ug/L	[6]	1	NA	50	0.07	**1**
Phenanthrene	85018	1100	ug/L	[6]	0.2	NA	10	0.04	0.2
Phenol	108952	1100	ug/L	[6]	0.2	NA	10	0.06	0.2
Pyrene	129000	110	ug/L	[6]	0.2	NA	10	0.06	0.2
Tentatively Identified Compounds	NA	NA	ug/L	NA	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCB Congeners and Homologs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 1	2051-60-7	64	pg/L	[1][2][3][4]	40	NA	200	6.73	40
PCB 2	2051-61-8	64	pg/L	[1][2][3][4]	40	NA	10	4.18	40
PCB 3	2051-62-9	64	pg/L	[1][2][3][4]	40	NA	200	6.44	40
PCB 4	13029-08-8	64	pg/L	[1][2][3][4]	60	NA	500	10.40	60
PCB 5	16605-91-7	64	pg/L	[1][2][3][4]	40	NA	50	4.60	40
PCB 6	25569-80-6	64	pg/L	[1][2][3][4]	40	NA	50	6.62	40
PCB 7	33284-50-3	64	pg/L	[1][2][3][4]	40	NA	50	3.85	40
PCB 8	34883-43-7	64	pg/L	[1][2][3][4]	60	NA	500	8.61	60
PCB 9	34883-39-1	64	pg/L	[1][2][3][4]	40	NA	50	4.60	40
PCB 10	33146-45-1	64	pg/L	[1][2][3][4]	40	NA	50	7.35	40
PCB 11	2050-67-1	64	pg/L	[1][2][3][4]	60	NA	200	36.37	60
PCB 12	2974-92-7	64	pg/L	[1][2][3][4]	60	NA	100	20.40	60
PCB 13	2974-90-5	64	pg/L	[1][2][3][4]	60	NA	100	20.40	60
PCB 14	34883-41-5	64	pg/L	[1][2][3][4]	40	NA	100	5.78	40
PCB 15	2050-68-2	64	pg/L	[1][2][3][4]	40	NA	500	10.81	40
PCB 16	38444-78-9	64	pg/L	[1][2][3][4]	40	NA	100	8.57	40
PCB 17	37680-66-3	64	pg/L	[1][2][3][4]	40	NA	200	10.95	40
PCB 18	37680-65-2	64	pg/L	[1][2][3][4]	60	NA	500	11.45	60
PCB 19	38444-73-4	64	pg/L	[1][2][3][4]	40	NA	100	9.67	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 20	38444-84-7	64	pg/L	[1][2][3][4]	40	NA	500	16.62	40
PCB 21	55702-46-0	64	pg/L	[1][2][3][4]	40	NA	200	12.64	40
PCB 22	38444-85-8	64	pg/L	[1][2][3][4]	40	NA	200	9.92	40
PCB 23	55720-44-0	64	pg/L	[1][2][3][4]	40	NA	200	3.16	40
PCB 24	55702-45-9	64	pg/L	[1][2][3][4]	40	NA	200	11.22	40
PCB 25	55712-37-3	64	pg/L	[1][2][3][4]	40	NA	200	7.67	40
PCB 26	38444-81-4	64	pg/L	[1][2][3][4]	40	NA	200	9.05	40
PCB 27	38444-76-7	64	pg/L	[1][2][3][4]	40	NA	200	5.63	40
PCB 28	7012-37-5	64	pg/L	[1][2][3][4]	40	NA	500	16.62	40
PCB 29	15862-07-4	64	pg/L	[1][2][3][4]	40	NA	200	9.05	40
PCB 30	35693-92-6	64	pg/L	[1][2][3][4]	60	NA	500	11.45	60
PCB 31	16606-02-3	64	pg/L	[1][2][3][4]	40	NA	500	10.12	40
PCB 32	38444-77-8	64	pg/L	[1][2][3][4]	40	NA	200	5.67	40
PCB 33	38444-86-9	64	pg/L	[1][2][3][4]	40	NA	200	12.64	40
PCB 34	37680-68-5	64	pg/L	[1][2][3][4]	40	NA	200	3.38	40
PCB 35	37680-69-6	64	pg/L	[1][2][3][4]	40	NA	200	9.58	40
PCB 36	38444-87-0	64	pg/L	[1][2][3][4]	40	NA	200	7.49	40
PCB 37	38444-90-5	64	pg/L	[1][2][3][4]	40	NA	500	8.96	40
PCB 38	53555-66-1	64	pg/L	[1][2][3][4]	40	NA	200	4.65	40
PCB 39	38444-88-1	64	pg/L	[1][2][3][4]	40	NA	200	7.33	40
PCB 40	38444-93-8	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40
PCB 41	52663-59-9	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 42	36559-22-5	64	pg/L	[1][2][3][4]	40	NA	200	4.04	40
PCB 43	70362-46-8	64	pg/L	[1][2][3][4]	40	NA	200	9.35	40
PCB 44	41464-39-5	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 45	70362-45-7	64	pg/L	[1][2][3][4]	40	NA	200	12.06	40
PCB 46	41464-47-5	64	pg/L	[1][2][3][4]	40	NA	200	2.62	40
PCB 47	2437-79-8	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 48	70362-47-9	64	pg/L	[1][2][3][4]	40	NA	200	2.55	40
PCB 49	41464-40-8	64	pg/L	[1][2][3][4]	40	NA	500	8.53	40
PCB 50	62796-65-0	64	pg/L	[1][2][3][4]	40	NA	200	9.16	40
PCB 51	68194-04-7	64	pg/L	[1][2][3][4]	40	NA	200	12.06	40
PCB 52	35693-99-3	64	pg/L	[1][2][3][4]	40	NA	500	7.50	40
PBB 53	41464419	64	pg/L	[1][2][3][4]	40	NA	500	9.16	40
PCB 54	15968-05-5	64	pg/L	[1][2][3][4]	40	NA	500	4.69	40
PCB 55	74338-24-2	64	pg/L	[1][2][3][4]	40	NA	500	6.13	40
PCB 56	41464-43-1	64	pg/L	[1][2][3][4]	40	NA	200	4.97	40
PCB 57	70424-67-8	64	pg/L	[1][2][3][4]	40	NA	500	4.62	40
PCB 58	41464-49-7	64	pg/L	[1][2][3][4]	40	NA	500	2.76	40
PCB 59	74472-33-6	64	pg/L	[1][2][3][4]	40	NA	200	11.65	40
PCB 60	33025-41-1	64	pg/L	[1][2][3][4]	40	NA	500	4.84	40
PCB 61	33284-53-6	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 62	54230-22-7	64	pg/L	[1][2][3][4]	40	NA	200	11.65	40
PCB 63	74472-34-7	64	pg/L	[1][2][3][4]	40	NA	500	4.77	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 64	52663-58-8	64	pg/L	[1][2][3][4]	40	NA	200	4.99	40
PCB 65	33284-54-7	64	pg/L	[1][2][3][4]	40	NA	500	10.67	40
PCB 66	32598-10-0	64	pg/L	[1][2][3][4]	40	NA	500	12.05	40
PCB 67	73575-53-8	64	pg/L	[1][2][3][4]	40	NA	500	5.69	40
PCB 68	73575-52-7	64	pg/L	[1][2][3][4]	40	NA	500	3.86	40
PCB 69	60233-24-1	64	pg/L	[1][2][3][4]	40	NA	500	8.53	40
PCB 70	32598-11-1	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 71	41464-46-4	64	pg/L	[1][2][3][4]	40	NA	500	6.45	40
PCB 72	41464-42-0	64	pg/L	[1][2][3][4]	40	NA	500	3.67	40
PCB 73	74338-23-1	64	pg/L	[1][2][3][4]	40	NA	500	9.35	40
PCB 74	32690-93-0	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 75	32598-12-2	64	pg/L	[1][2][3][4]	40	NA	500	11.65	40
PCB 76	70362-48-0	64	pg/L	[1][2][3][4]	40	NA	500	23.80	40
PCB 77	32598-13-3	50	pg/L	[1][3]	40	NA	500	4.36	40
PCB 78	70362-49-1	64	pg/L	[1][2][3][4]	40	NA	500	4.43	40
PCB 79	41464-48-6	64	pg/L	[1][2][3][4]	40	NA	500	3.15	40
PCB 80	33284-52-5	64	pg/L	[1][2][3][4]	40	NA	500	3.59	40
PCB 81	70362-50-4	17	pg/L	[1][3]	40	NA	500	3.41	**40**
PCB 82	52663-62-4	64	pg/L	[1][2][3][4]	40	NA	500	8.29	40
PCB 83	60145-20-2	64	pg/L	[1][2][3][4]	40	NA	500	9.28	40
PCB 84	52663-60-2	64	pg/L	[1][2][3][4]	40	NA	500	5.97	40
PCB 85	65510-45-4	64	pg/L	[1][2][3][4]	40	NA	500	8.37	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 86	55312-69-1	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 87	38380-02-8	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 88	55215-17-3	64	pg/L	[1][2][3][4]	40	NA	500	7.37	40
PCB 89	73575-57-2	64	pg/L	[1][2][3][4]	40	NA	500	5.57	40
PCB 90	68194-07-0	64	pg/L	[1][2][3][4]	40	NA	500	4.70	40
PCB 91	68194-05-8	64	pg/L	[1][2][3][4]	40	NA	500	7.37	40
PCB 92	52663-61-3	64	pg/L	[1][2][3][4]	40	NA	500	3.67	40
PCB 93	73575-56-1	64	pg/L	[1][2][3][4]	40	NA	500	7.55	40
PCB 94	73575-55-0	64	pg/L	[1][2][3][4]	40	NA	500	4.51	40
PCB 95	38379-99-6	64	pg/L	[1][2][3][4]	40	NA	500	6.75	40
PCB 96	73575-54-9	64	pg/L	[1][2][3][4]	40	NA	500	2.64	40
PCB 97	41464-51-1	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 98	60233-25-2	64	pg/L	[1][2][3][4]	40	NA	500	12.09	40
PCB 99	38380-01-7	64	pg/L	[1][2][3][4]	40	NA	500	17.70	40
PCB 100	39485-83-1	64	pg/L	[1][2][3][4]	40	NA	500	7.55	40
PCB 101	37680-73-2	64	pg/L	[1][2][3][4]	40	NA	1000	4.70	40
PCB 102	68194-06-9	64	pg/L	[1][2][3][4]	40	NA	500	12.09	40
PCB 103	60145-21-3	64	pg/L	[1][2][3][4]	40	NA	500	2.52	40
PCB 104	56558-16-8	64	pg/L	[1][2][3][4]	40	NA	500	5.75	40
PCB 105	32598-14-4	167	pg/L	[1][3]	40	NA	200	4.45	40
PCB 106	70424-69-0	64	pg/L	[1][2][3][4]	40	NA	500	5.80	40
PCB 107	70424-68-9	64	pg/L	[1][2][3][4]	40	NA	200	3.72	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 108	70362-41-3	64	pg/L	[1][2][3][4]	40	NA	1000	22.86	40
PCB 109	74472-35-8	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 110	38380-03-9	64	pg/L	[1][2][3][4]	40	NA	1000	7.25	40
PCB 111	39635-32-0	64	pg/L	[1][2][3][4]	40	NA	1000	3.43	40
PCB 112	74472-36-9	64	pg/L	[1][2][3][4]	40	NA	1000	17.70	40
PCB 113	68194-10-5	64	pg/L	[1][2][3][4]	40	NA	1000	4.70	40
PCB 114	74472-37-0	167	pg/L	[1][3]	40	NA	500	4.67	40
PCB 115	74472-38-1	64	pg/L	[1][2][3][4]	40	NA	1000	7.25	40
PCB 116	18259-05-7	64	pg/L	[1][2][3][4]	40	NA	200	8.37	40
PCB 117	68194-11-6	64	pg/L	[1][2][3][4]	40	NA	200	8.37	40
PCB 118	31508-00-6	167	pg/L	[1][3]	40	NA	500	6.27	40
PCB 119	56558-17-9	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 120	68194-12-7	64	pg/L	[1][2][3][4]	40	NA	500	3.45	40
PCB 121	56558-18-0	64	pg/L	[1][2][3][4]	40	NA	500	3.45	40
PCB 122	76842-07-4	64	pg/L	[1][2][3][4]	40	NA	500	4.58	40
PCB 123	65510-44-3	167	pg/L	[1][3]	40	NA	500	5.04	40
PCB 124	70424-70-3	64	pg/L	[1][2][3][4]	40	NA	1000	22.86	40
PCB 125	74472-39-2	64	pg/L	[1][2][3][4]	40	NA	500	10.46	40
PCB 126	57465-28-8	0.05	pg/L	[1][3]	40	NA	500	**2.16**	**40**
PCB 127	39635-33-1	64	pg/L	[1][2][3][4]	40	NA	1000	6.56	40
PCB 128	38380-07-3	64	pg/L	[1][2][3][4]	40	NA	500	10.78	40
PCB 129	55215-18-4	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 130	52663-66-8	64	pg/L	[1][2][3][4]	40	NA	500	8.69	40
PCB 131	61798-70-7	64	pg/L	[1][2][3][4]	40	NA	500	1.27	40
PCB 132	38380-05-1	64	pg/L	[1][2][3][4]	40	NA	500	4.62	40
PCB 133	35694-04-3	64	pg/L	[1][2][3][4]	40	NA	500	2.67	40
PCB 134	52704-70-8	64	pg/L	[1][2][3][4]	40	NA	500	10.43	40
PCB 135	52744-13-5	64	pg/L	[1][2][3][4]	40	NA	500	6.28	40
PCB 136	38411-22-2	64	pg/L	[1][2][3][4]	40	NA	200	3.36	40
PCB 137	35694-06-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.50	40
PCB 138	35065-28-2	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40
PCB 139	56030-56-9	64	pg/L	[1][2][3][4]	40	NA	500	4.37	40
PCB 140	59291-64-4	64	pg/L	[1][2][3][4]	40	NA	500	4.37	40
PCB 141	52712-04-6	64	pg/L	[1][2][3][4]	40	NA	200	3.77	40
PCB 142	41411-61-4	64	pg/L	[1][2][3][4]	40	NA	1000	4.40	40
PCB 143	68194-15-0	64	pg/L	[1][2][3][4]	40	NA	500	10.43	40
PCB 144	68194-14-9	64	pg/L	[1][2][3][4]	40	NA	500	5.50	40
PCB 145	74472-40-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.12	40
PCB 146	51908-16-8	64	pg/L	[1][2][3][4]	40	NA	500	4.91	40
PCB 147	68194-13-8	64	pg/L	[1][2][3][4]	40	NA	500	4.52	40
PCB 148	74472-41-6	64	pg/L	[1][2][3][4]	40	NA	1000	5.00	40
PCB 149	38380-04-0	64	pg/L	[1][2][3][4]	40	NA	1000	4.52	40
PCB 150	68194-08-1	64	pg/L	[1][2][3][4]	40	NA	1000	3.41	40
PCB 151	52663-63-5	64	pg/L	[1][2][3][4]	40	NA	500	6.28	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 152	68194-09-2	64	pg/L	[1][2][3][4]	40	NA	1000	2.30	40
PCB 153	35065-27-1	64	pg/L	[1][2][3][4]	40	NA	500	7.11	40
PCB 154	60145-22-4	64	pg/L	[1][2][3][4]	40	NA	500	4.88	40
PCB 155	33979-03-2	64	pg/L	[1][2][3][4]	40	NA	1000	3.16	40
PCB 156	38380-08-4	167	pg/L	[1][3]	40	NA	500	4.48	40
PCB 157	69782-90-7	167	pg/L	[1][3]	40	NA	500	4.48	40
PCB 158	74472-42-7	64	pg/L	[1][2][3][4]	40	NA	200	2.46	40
PCB 159	39635-35-3	64	pg/L	[1][2][3][4]	40	NA	1000	3.38	40
PCB 160	41411-62-5	64	pg/L	[1][2][3][4]	40	NA	500	7.22	40
PCB 161	74472-43-8	64	pg/L	[1][2][3][4]	40	NA	1000	2.62	40
PCB 162	39635-34-2	64	pg/L	[1][2][3][4]	40	NA	1000	4.07	40
PCB 163	74472-44-9	64	pg/L	[1][2][3][4]	40	NA	500	8.91	40
PCB 164	74472-45-0	64	pg/L	[1][2][3][4]	40	NA	500	3.50	40
PCB 165	74472-46-1	64	pg/L	[1][2][3][4]	40	NA	1000	4.06	40
PCB 166	41411-63-6	64	pg/L	[1][2][3][4]	40	NA	500	10.78	40
PCB 167	52663-72-6	167	pg/L	[1][3]	40	NA	500	4.96	40
PCB 168	59291-65-5	64	pg/L	[1][2][3][4]	40	NA	500	7.11	40
PCB 169	32774-16-6	0.167	pg/L	[1][3]	40	NA	500	**3.63**	**40**
PCB 170	35065-30-6	64	pg/L	[1][2][3][4]	40	NA	500	2.91	40
PCB 171	52663-71-5	64	pg/L	[1][2][3][4]	40	NA	1000	7.80	40
PCB 172	52663-74-8	64	pg/L	[1][2][3][4]	40	NA	1000	3.37	40
PCB 173	68194-16-1	64	pg/L	[1][2][3][4]	40	NA	1000	7.80	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 174	38411-25-5	64	pg/L	[1][2][3][4]	40	NA	500	6.46	40
PCB 175	40186-70-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.63	40
PCB 176	52663-65-7	64	pg/L	[1][2][3][4]	40	NA	1000	2.20	40
PCB 177	52663-70-4	64	pg/L	[1][2][3][4]	40	NA	500	2.24	40
PCB 178	52663-67-9	64	pg/L	[1][2][3][4]	40	NA	500	2.88	40
PCB 179	52663-64-6	64	pg/L	[1][2][3][4]	40	NA	500	2.47	40
PCB 180	35065-29-3	64	pg/L	[1][2][3][4]	40	NA	500	7.77	40
PCB 181	74472-47-2	64	pg/L	[1][2][3][4]	40	NA	1000	5.44	40
PCB 182	60145-23-5	64	pg/L	[1][2][3][4]	40	NA	1000	3.59	40
PCB 183	52663-69-1	64	pg/L	[1][2][3][4]	40	NA	1000	4.27	40
PCB 184	74472-48-3	64	pg/L	[1][2][3][4]	40	NA	1000	3.31	40
PCB 185	52712-05-7	64	pg/L	[1][2][3][4]	40	NA	1000	4.27	40
PCB 186	74472-49-4	64	pg/L	[1][2][3][4]	40	NA	1000	4.18	40
PCB 187	52663-68-0	64	pg/L	[1][2][3][4]	40	NA	500	4.50	40
PCB 188	74487-85-7	64	pg/L	[1][2][3][4]	40	NA	500	4.32	40
PCB 189	39635-31-9	167	pg/L	[1][3]	40	NA	500	2.80	40
PCB 190	41411-64-7	64	pg/L	[1][2][3][4]	40	NA	500	2.46	40
PCB 191	74472-50-7	64	pg/L	[1][2][3][4]	40	NA	1000	3.13	40
PCB 192	74472-51-8	64	pg/L	[1][2][3][4]	40	NA	1000	3.67	40
PCB 193	69782-91-8	64	pg/L	[1][2][3][4]	40	NA	500	7.77	40
PCB 194	35694-08-7	64	pg/L	[1][2][3][4]	40	NA	500	4.98	40
PCB 195	52663-78-2	64	pg/L	[1][2][3][4]	40	NA	1000	6.21	40

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
PCB 196	42740-50-1	64	pg/L	[1][2][3][4]	40	NA	1000	6.18	40
PCB 197	33091-17-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.59	40
PCB 198	68194-17-2	64	pg/L	[1][2][3][4]	40	NA	500	12.97	40
PCB 199	52663-75-9	64	pg/L	[1][2][3][4]	40	NA	500	12.97	40
PCB 200	52663-73-7	64	pg/L	[1][2][3][4]	40	NA	1000	5.59	40
PCB 201	40186-71-8	64	pg/L	[1][2][3][4]	40	NA	1000	4.29	40
PCB 202	2136-99-4	64	pg/L	[1][2][3][4]	40	NA	1000	3.91	40
PCB 203	52663-76-0	64	pg/L	[1][2][3][4]	40	NA	1000	4.91	40
PCB 204	74472-52-9	64	pg/L	[1][2][3][4]	40	NA	1000	3.06	40
PCB 205	74472-53-0	64	pg/L	[1][2][3][4]	40	NA	1000	5.50	40
PCB 206	40186-72-9	64	pg/L	[1][2][3][4]	40	NA	1000	3.17	40
PCB 207	52663-79-3	64	pg/L	[1][2][3][4]	40	NA	1000	2.68	40
PCB 208	52663-77-1	64	pg/L	[1][2][3][4]	40	NA	1000	3.49	40
PCB 209	2051-24-3	64	pg/L	[1][2][3][4]	40	NA	500	2.47	40
Monochlorobiphenyl	27323-18-8	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Dichlorobiphenyl	25512-42-9	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Trichlorobiphenyl	25323-68-6	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Tetrachlorobiphenyl	26914-33-0	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Pentachlorobiphenyl	25429-29-2	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Hexachlorobiphenyl	26601-64-9	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Heptachlorobiphenyl	28655-71-2	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
Octachlorobiphenyl	55722-26-4	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA
Nonachlorobiphenyl	53742-07-7	64	pg/L	[1][2][3][4]	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: TAL Metals + Titanium, Hexavalent Chromium, and Methyl Mercury
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
							MDLs	Method QLs	MDLs	QLs
Aluminum	7429905	C-3, C-4	50	ug/L	[5]	2	NA	NA	0.3	2
Antimony	7440360	C-3, C-5	1.5	ug/L	[6]	0.05	NA	NA	0.02	0.05
Arsenic	7440382	C-5, C-6	0.017	ug/L	[1]	0.5	NA	NA	**0.1**	**0.5**
Arsenic	7440382	C-3, C-5	0.017	ug/L	[1]	0.5	NA	NA	**0.03**	**0.5**
Barium	7440393	C-3, C-5	4	ug/L	[11]	0.05	NA	NA	0.02	0.05
Beryllium	7440417	C-3, C-5	0.66	ug/L	[11]	0.02	NA	NA	0.006	0.02
Beryllium	7440417	C-5, C-6	0.66	ug/L	[11]	0.02	NA	NA	0.0007	0.02
Cadmium	7440439	C-3, C-5	0.18	ug/L	[7]	0.02	NA	NA	0.005	0.02
Cadmium	7440439	C-5, C-6	0.18	ug/L	[7]	0.02	NA	NA	0.001	0.02
Calcium	7440702	C-3, C-4	NA	ug/L	NA	4	NA	NA	2	4
Chromium	7440473	C-3, C-5	0.043	ug/L	[6]	0.2	NA	NA	0.04	**0.2**
Chromium	7440473	C-5, C-6	0.043	ug/L	[6]	0.2	NA	NA	0.02	**0.2**
Chromium (VI)	18540299	C-15	0.043	ug/L	[6]	10	NA	NA	0.01	0.02
Cobalt	7440484	C-3, C-5	1.1	ug/L	[6]	0.02	NA	NA	0.006	0.02
Cobalt	7440484	C-5, C-6	1.1	ug/L	[6]	0.02	NA	NA	0.002	0.02
Copper	7440508	C-3, C-5	3.1	ug/L	[10]	0.1	NA	NA	0.02	0.1
Copper	7440508	C-5, C-6	3.1	ug/L	[10]	0.1	NA	NA	0.03	0.1
Iron	7439896	C-3, C-4	300	ug/L	[3][5]	10	NA	NA	3	10
Lead	7439921	C-3, C-5	2.5	ug/L	[9]	0.02	NA	NA	0.005	0.02

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	Laboratory SOP[f]	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
							MDLs	Method QLs	MDLs	QLs
Lead	7439921	C-5, C-6	2.5	ug/L	[9]	0.02	NA	NA	0.008	0.04
Magnesium	7439954	C-3, C-4	NA	ug/L	NA	2	NA	NA	0.4	2
Manganese	7439965	C-3, C-5	50	ug/L	[3][5]	0.05	NA	NA	0.006	0.05
Mercury	7439976	B-1	50	ng/L	[1]	1	NA	NA	0.15	0.4
Methyl mercury	22967926	B-2	2.8	ng/L	[11]	0.05	NA	0.02	0.02	0.05
Nickel	7440020	C-3, C-5	8.2	ug/L	[10]	0.2	NA	NA	0.03	0.2
Nickel	7440020	C-5, C-6	8.2	ug/L	[10]	0.2	NA	NA	0.04	0.2
Potassium	7440097	C-3, C-4	NA	ug/L	NA	100	NA	NA	50	100
Silver	7440224	C-3, C-5	0.36	ug/L	[11]	0.02	NA	NA	0.004	0.02
Silver	7440224	C-5, C-6	0.36	ug/L	[11]	0.02	NA	NA	0.002	0.02
Selenium	7782492	C-3, C-5	5	ug/L	[7][9]	1	NA	NA	0.3	1
Sodium	7440235	C-3, C-4	NA	ug/L	NA	200	NA	NA	70	200
Thallium	7440280	C-3, C-5	0.037	ug/L	[6]	0.02	NA	NA	0.005	0.02
Thallium	7440280	C-5, C-6	0.037	ug/L	[6]	0.02	NA	NA	0.004	0.02
Titanium	7440326	C-3, C-4	0.00015	ug/L	[6]	1	NA	NA	**0.04**	**1**
Vanadium	7440622	C-3, C-5	18	ug/L	[6]	0.2	NA	NA	0.03	0.2
Zinc	7440666	C-3, C-5	81	ug/L	[8][10]	0.5	NA	NA	0.2	0.5
Zinc	7440666	C-5, C-6	81	ug/L	[8][10]	0.5	NA	NA	0.05	0.5

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PCDD/PCDFs
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001020	17	pg/L	[1][3]	50	NA	50	6.5	**50**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268879	17	pg/L	[1][3]	50	NA	50	7.5	**50**
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562394	0.5	pg/L	[1][3]	25	NA	50	**1.3**	**25**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822469	0.5	pg/L	[1][3]	25	NA	50	**3.1**	**25**
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673897	0.5	pg/L	[1][3]	25	NA	50	**2**	**25**
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648269	0.05	pg/L	[1][3]	25	NA	50	**2.1**	**25**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227286	0.05	pg/L	[1][3]	25	NA	50	**2.1**	**25**
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117449	0.05	pg/L	[1][3]	25	NA	50	**0.96**	**25**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653857	0.05	pg/L	[1][3]	25	NA	50	**2.2**	**25**
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918219	0.05	pg/L	[1][3]	25	NA	50	**1.6**	**25**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408743	0.05	pg/L	[1][3]	25	NA	50	**2.5**	**25**
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117416	0.17	pg/L	[1][3]	25	NA	50	**1.8**	**25**
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321764	0.005	pg/L	[1][3]	25	NA	50	**1.9**	**25**
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851345	0.05	pg/L	[1][3]	25	NA	50	**1**	**25**
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117314	0.017	pg/L	[1][3]	25	NA	50	**1.6**	**25**
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207319	0.05	pg/L	[1][3]	5	NA	10	**1.2**	**5**
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746016	0.005	pg/L	[1][3]	5	NA	10	**1.2**	**5**
Total Heptachlorodibenzofuran (HpCDF)	3898-75-3	NA	pg/L	NA	50	NA	NA	NA	50
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4	NA	pg/L	NA	50	NA	NA	NA	50

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	NA	pg/L	NA	50	NA	NA	NA	50
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8	NA	pg/L	NA	50	NA	NA	NA	50
Total Pentachlorodibenzofuran (PeCDF)	60402-15-4	NA	pg/L	NA	50	NA	NA	NA	50
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9	NA	pg/L	NA	50	NA	NA	NA	50
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	NA	pg/L	NA	50	NA	NA	NA	50
Total Tetrachlorodibenzo-p-dioxin (TCDD)	41903-57-5	NA	pg/L	NA	50	NA	NA	NA	50

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: General Chemistry
Concentration Level: Low

Analyte	CAS Number	Laboratory SOP[f]	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
							MDLs	Method QLs	MDLs	QLs
Total Organic Carbon (TOC)	NA	C-13	NA	ug/L	NA	300	NA	NA	30	300
Dissolved Organic Carbon (DOC)	NA	C-13	NA	ug/L	NA	300	NA	NA	100	300
Particulate Organic Carbon (POC)	NA	C-16	NA	mg/kg	NA	1300	NA	NA	500	1300
Suspended Sediment Concentrations	NA	C-17	NA	ug/L	NA	NA	NA	NA	1000	NA
Total Dissolved Solids	NA	C-19	NA	ug/L	NA	5000	NA	NA	5000	5000
Hardness	NA	C-18	NA	ug/L	NA	1000	NA	NA	NA	1000
Alkalinity	NA	C-20	NA	ug/L	NA	2	NA	NA	1	2
Ammonia	7664-41-7	C-9	50	ug/L	[8]	0.05	NA	NA	0.02	0.05
Total Kjeldahl Nitrogen	7727-37-9	C-12	NA	ug/L	NA	0.2	NA	NA	0.08	0.2
Total Phosphorus	14365-44-2	C-11	NA	ug/L	NA	0.01	NA	NA	0.004	0.01
Total Sulfide	18496-25-8	C-14	NA	ug/L	NA	2	NA	NA	0.3	2
Sulfate	14808-79-8	C-21	NA	ug/L	NA	0.2	NA	NA	0.01	0.2
Chloride	NA	C-21	NA	ug/L	NA	0.2	NA	NA	0.03	0.2
Chlorophyll a	42617163	C-22	NA	mg/m^3	NA	0.8	NA	NA	0.3	0.8
Cyanide	57-12-5	C-10	1	ug/L	[8][10]	0.01	NA	NA	0.003	0.01

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: PAHs and alkyl PAHs by LRMS-SIM isotope dilution
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
1-Methylnaphthalene	90120	2100	ng/L	[11]	10	NA	NA	4.1	10
1-Methylphenanthrene	832699	1100000	ng/L	[6]	10	NA	NA	0.7	10
2,3,5-Trimethylnaphthalene	2245387	140	ng/L	[6]	10	NA	NA	1.6	10
2,6-Dimethylnaphthalene	581420	140	ng/L	[6]	10	NA	NA	2.2	10
2-Methylnaphthalene	91576	15000	ng/L	[6]	20	NA	NA	8.3	20
Acenaphthene	83329	220000	ng/L	[6]	10	NA	NA	2.4	10
Acenaphthylene	208968	220000	ng/L	[6]	10	NA	NA	0.15	10
Anthracene	120127	730	ng/L	[11]	10	NA	NA	0.71	10
Fluorene	86737	3900	ng/L	[11]	10	NA	NA	1.5	10
Naphthalene	91203	140	ng/L	[6]	50	NA	NA	16	50
Phenanthrene	85018	1100000	ng/L	[6]	20	NA	NA	11	20
Benzo[a]anthracene	56553	3.8	ng/L	[3]	10	NA	NA	1.5	**10**
Benzo[a]pyrene	50328	2.9	ng/L	[6]	10	NA	NA	0.4	**10**
Benzo[b]fluoranthene	205992	3.8	ng/L	[3]	10	NA	NA	1.5	**10**
Benzo[e]pyrene	192972	200	ng/L	[5]	10	NA	NA	1.4	10
Benzo[g,h,i]perylene	191242	110000	ng/L	[6]	10	NA	NA	0.51	10
Benzo[k]fluoranthene	207089	3.8	ng/L	[3]	10	NA	NA	1	**10**
Chrysene	218019	3.8	ng/L	[3]	10	NA	NA	0.22	**10**
Dibenzo[a,h]anthracene	53703	2.9	ng/L	[6]	10	NA	NA	0.78	**10**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
Dibenzothiophene	132650	NA	ng/L	NA	10	NA	NA	0.69	10
Fluoranthene	206440	130000	ng/L	[1][3]	10	NA	NA	2.4	10
Indeno(1,2,3-cd)pyrene	193395	3.8	ng/L	[3]	10	NA	NA	1	**10**
Perylene	198550	110000	ng/L	[6]	10	NA	NA	0.81	10
Pyrene	129000	110000	ng/L	[6]	10	NA	NA	1.7	10
C1-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C1-Pyrene/fluoranthenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C2-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Fluorenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C3-Phenanthrene/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Benzanthracene/chrysenes	NA	NA	ng/L	NA	10	NA	NA	10	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
C4-Dibenzothiophenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Naphthalenes	NA	NA	ng/L	NA	10	NA	NA	10	10
C4-Phenanthrenes/anthracenes	NA	NA	ng/L	NA	10	NA	NA	10	10

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: OC Pesticides
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
alpha-BHC	319846	2.6	ng/L	[1][3]	0.4	NA	0.06	0.012	0.4
beta-BHC	319857	9.1	ng/L	[1][3]	0.4	NA	0.06	0.015	0.4
delta-BHC	319868	2.6	ng/L	[1][3]	0.4	NA	0.06	0.018	0.4
gamma-BHC (Lindane)	58899	61	ng/L	[6]	0.4	NA	0.06	0.016	0.4
Heptachlor	76448	0.079	ng/L	[1][2][3][4]	0.4	NA	0.03	0.011	**0.4**
Aldrin	309002	0.049	ng/L	[1][3]	0.4	NA	0.09	0.036	**0.4**
Heptachlor epoxide	1024573	0.039	ng/L	[1][2][3][4]	0.4	NA	0.04	0.013	**0.4**
Endosulfan I	959988	8.7	ng/L	[8][10]	0.4	NA	0.1	0.066	2.0
Dieldrin	60571	0.052	ng/L	[1][3]	0.4	NA	0.03	0.021	**0.4**
4,4'-DDE	72559	0.22	ng/L	[1][2][3][4]	0.4	NA	0.03	0.080	**0.4**
2,4'-DDE	3424826	0.22	ng/L	[1][2][3][4]	0.4	NA	0.03	0.062	**0.4**
Endrin	72208	2.3	ng/L	[8][10]	0.4	NA	0.03	0.157	0.4
Endosulfan II	33213659	8.7	ng/L	[8][10]	0.4	NA	0.1	0.093	0.4
4,4'-DDD	72548	0.31	ng/L	[1][2][3][4]	0.4	NA	0.03	0.030	**0.4**
2,4'-DDD	53190	0.31	ng/L	[1][2][3][4]	0.4	NA	0.03	0.029	**0.4**
Endosulfan sulfate	1031078	8.7	ng/L	[8][10]	0.4	NA	0.04	0.010	0.4
4,4'-DDT	50293	0.22	ng/L	[1][2][3][4]	0.4	NA	0.03	0.044	**0.4**
2,4'-DDT	789026	0.22	ng/L	[1][2][3][4]	0.4	NA	0.03	0.039	**0.4**
Methoxychlor	72435	19	ng/L	[11]	0.4	NA	0.03	0.012	0.4

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL[b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	EDLs	QLs
Endrin ketone	53494705	2.3	ng/L	[8][10]	0.4	NA	0.04	0.022	0.4
Endrin aldehyde	7421934	2.3	ng/L	[8][10]	0.4	NA	0.04	0.037	0.4
cis-Chlordane	5103719	0.1	ng/L	[1]	0.4	NA	0.03	0.021	**0.4**
trans-Chlordane	5103742	0.1	ng/L	[1]	0.4	NA	0.05	0.023	**0.4**
Oxychlordane	27304138	0.1	ng/L	[1]	0.4	NA	0.06	0.029	**0.4**
cis-Nonachlor	5103731	0.1	ng/L	[1][3]	0.4	NA	0.03	0.029	**0.4**
trans-Nonachlor	3734494	0.1	ng/L	[1]	0.4	NA	0.04	0.024	**0.4**
Hexachlorobenzene	118741	0.28	ng/L	[1][3]	0.4	NA	0.04	0.003	**0.4**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: Butyltins
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL [b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
Monobutyltin	78763-54-9	1100	ng/L	[6]	50	NA	NA	29	50
Dibutyltin	14488-53-0	1100	ng/L	[6]	50	NA	NA	7.3	50
Tributyltin	36643-28-4	1100	ng/L	[6]	50	NA	NA	38	50
Tetrabutyltin	1461-25-2	1100	ng/L	[6]	50	NA	NA	12	50

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

Matrix: Water
Analytical Group: Bacteria and Protozoa
Concentration Level: Low

Analyte	CAS Number	PAL[a]	Units	PAL Source[a]	Project QL [b] (ug/L)	Analytical Method[c]		Achievable Laboratory Limits[d,e]	
						MDLs	Method QLs	MDLs	QLs
Total coliform bacteria	NA	NA	CFU/100mL	NA	1	NA	1	NA	1
E. coli	NA	NA	CFU/100mL	NA	1	NA	1	NA	1
Fecal coliform bacteria	NA	NA	CFU/100mL	NA	1	NA	1	NA	1
Fecal streptococci bacteria	NA	NA	CFU/100mL	NA	1	NA	1	NA	1
Fecal enterococci bacteria	NA	NA	CFU/100mL	NA	1	NA	1	NA	1
Cryptosporidium	137259-50-8	NA	Oocysts/L	NA	1	NA	1	NA	1
Giardia	137259-49-5	NA	Cysts/L	NA	1	NA	1	NA	1

[a] Project Action Limits (PALs) are based on the lower of:
[1] NJDEP (2008) Human Health Surface Water Quality Level - freshwater
[2] NJDEP (2008) Human Health Surface Water Quality Level - saline water
[3] USEPA (2009a) Ambient Water Quality Criterion for consumption of water and organisms
[4] USEPA (2009a) Ambient Water Quality Criterion for consumption of organisms
[5] USEPA (2011a) Maximum Contaminant Levels (MCLs)
[6] USEPA (2011b) Regional Screening Values (RSLs) for tap water
[7] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - freshwater
[8] NJDEP (2008) Chronic Aquatic Life Surface Water Quality Level - saline water
[9] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - freshwater
[10] USEPA (2009a) Chronic Aquatic Life Ambient Water Quality Criterion - saltwater
[11] Tier II chronic values (Suter and Tsao, 1996)

[b] Project QLs are equivalent to the Achievable Laboratory Quantitation Limits.

[c] Analytical MDLs and QLs are those documented in validated methods.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels and Analytical Method Evaluation

[d] Achievable MDLs and QLs are limits that the selected laboratory can achieve when performing the specified methods (Worksheet #23) with nominal sample volumes in the absence of interferences. Actual MDLs and QLs will vary based on sample specific factors. QLs listed for PCBs are equivalent to the Minimum Level (ML) per reference method definitions and may not be based on the low point of calibration. EDLs for isotope dilution methods are based on average blank EDL results. The actual reporting limits for isotope dilution methods will be the sample specific EDL rather than QL. All results between the MDL (or EDL) and QL will be reported as estimated values (J qualifier). The reporting limit will be the QL for all methods except isotope dilution methods.

[e] Achievable laboratory limits that are greater than the PALs are presented in boldface text.

[f] Refer to Worksheet #23 for Laboratory SOPs.

QAPP Worksheet #16 (UFP-QAPP Manual Section 2.8.2) Project Schedule/Timeline Table

		Dates (MM/DD/YY)			
Activities	**Organization**	**Anticipated Date(s) of Initiation**	**Anticipated Date of Completion**	**Deliverable**	**Deliverable Due Date**
Project Status	de maximis/ AECOM	Monthly	Monthly	Progress report	15th of each month
Planning and Development of Study Objectives	de maximis/ AECOM	February 2010	February 2012	QAPP/ FSP Addendum for Small Volume Sampling QAPP/ FSP Addendum for High Volume Sampling	July 2011 February 2012
Sampling events[1]	AECOM	August 2011	August 2012	Noted in monthly progress report	NA
Collection of Samples and Submission for Analysis	AECOM	August 2011	August 2012	NA	NA
Laboratory Analysis	AECOM	August 2011	September 2012	Analytical data to CPG	Beginning at 30 days after collection. See Worksheet #30 for turnaround times
Data Validation and Verification	AECOM	October 2011	October 2012 Multiple events	Data validation reports (DVRs) with data delivery	Four weeks following receipt of final laboratory data
Preparation and Delivery of Technical Memorandum to USEPA	de maximis/ AECOM	March 2012	March 2013	Technical Memoranda	March 2013

[1]Five routine events, two high flow events, and one low flow/spring tide event will be conducted during this period. Timing and duration of surveys are dependent on weather conditions and flow regimes.

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): The proposed sampling locations are presented in Figure 1 of the FSP Addendum (Appendix A) for this work. Sampling locations were chosen to provide:

(1) chemical concentration data from locations, in some instances, where physical parameters such as solids and organic carbon data have been collected during the PWCM program;

(2) spatial coverage in the LPRSA for calculation of EPCs for the HHRA, ERA, and FWM;

(3) information regarding the chemical concentrations at the model domain boundaries and at inputs to the Passaic, such as the NBSA, LPRSA tributaries, and above Dundee Dam to determine potential upgradient sources to the LPR;

(4) boundary conditions to Newark Bay and a range within Newark Bay of potential influences from the LPR; and,

(5) chemical concentration data associated with suspended solids in the water column that are likely to occur under different flows (see Worksheet #11, Project Quality Objectives).

Where the salt wedge may be present at a sampling location (stations located in RM 0 - 17.4 of the LPRSA and the NBSA), two samples will be collected: one from the upper water column (3 ft below surface) and one from the lower water column (3 ft from the bottom). These data will provide information regarding the effect of the salt wedge on the suspension and movement of chemical in the LPRSA and NBSA (i.e., are chemicals suspended in the water column near-bottom in the presence of the salt wedge). Collection of distinct freshwater and salt water data will also be used to develop salinity-based exposure concentrations for the ERA and FWM. Collection of water near-surface will provide information to the HHRA of the most likely exposure zone during human contact (e.g., swimming or boating). At locations above Dundee Dam and in the LPRSA tributaries, samples will be collected from mid-water column.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

The sampling design incorporates the full extent of the lower river (RM 0 to 17.4), above Dundee Dam, LPRSA tributaries, and the NBSA and will require periodic event-based discrete sampling of target analytes in the water column. The proposed RI small volume CWCM project includes the following sampling events:

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

- Five Routine Events.
- One Low Flow/Spring Tide Event
- Two High Flow Events

The flow thresholds for the low flow and high flow events were selected from an analysis of the discharge record at Dundee Dam (April 2007 to August 2010). The low flow event threshold was identified by conducting an analysis of the number of events satisfying both the discharge criterion and the spring-tide criterion. The analysis showed that a discharge criterion of <400 cfs was satisfied multiple times (i.e., 8-12 times per calendar years 2007-2009) in each of the years over the period of record at Dundee Dam.

The high flow threshold was identified by conducting a return frequency analysis using the available discharge data at Dundee Dam. A flow event with a return period of 3 months (or 4 occurrences per year), was chosen as the flow threshold that can reasonably be expected to be exceeded during the CWCM period. Accordingly, the discharge associated with the 1 in 3 months event at Dundee Dam was calculated to be 3000 cfs and is proposed as the minimum flow for a high flow event.

Routine Events. Five Routine Events are proposed over the course of approximately one year under normal flow conditions (400 - 3,000 cfs at Dundee Dam). The events are scheduled to occur in winter (one event), spring (two events) and summer (two events) and will capture at least one spring tide and one neap tide. The sample locations will include the LPRSA (including the LPRSA tributaries), above Dundee Dam, and the NBSA (Worksheet #18). The data collected during the Routine Events will provide data to support the EPCs for the RAs and FWM. A variety of flows (ranging from 400 to 3,000 cfs at Dundee Dam) will be targeted for the Routine Events, designed to provide information regarding the variability of chemical concentrations in the study area to support the calibration and validation of the CFT model. It is anticipated the Routine Events will capture data representative of the normal influxes and mixing processes in the river and the bay, the deposition of particulates from the water column to the sediment, and of the diffusive flux of contaminants from the sediments to the water column. One hundred (100) samples will be collected during each of the Routine Events to be analyzed for target analytes as defined in Worksheet #15. Group A analytes will be sampled in each event. Group B analytes will be measured in one spring and two summer events. Group B analyte data will be used to validate the model and in the RI and risk assessments. Group B will not be analyzed in winter and spring, as potential exposures and biological activity are lower than in other seasons. Shallow (3 ft below surface) water stations in the five locations in the lower 17.4 miles of the LPR will be analyzed for pathogens (Worksheet #15 and #18). Group C analytes (coliform bacteria) will be analyzed in the two spring and two summer events; and Group D analytes (*Giardia* and cryptosporidium) will be sampled during the summer events. Frequency and type of QC samples are provided in Worksheet #20.

Low Flow/Spring Tide Event. One Low Flow/Spring Tide Event is proposed under low flow conditions (<400 cfs at Dundee Dam) during a Spring Tide. The sample locations will include the stations in the LPRSA and above Dundee Dam (Worksheet #18). The data collected during the Low

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Flow/Spring Tide Event will provide additional data in the lower reaches of the river to support the EPCs for the RAs and FWM. Combining low-flow conditions with a spring tide will provide data to the CFT model when the highest tidal energies and tidal mixing may occur. Forty-four (44) samples will be collected during the Low Flow/Spring Tide Event to be analyzed for Group A and Group B target analytes as defined in Worksheet #15. Shallow (3 ft below surface) water stations in the five locations in the lower 17.4 miles of the LPR will be analyzed for Group C analytes (coliform bacteria) (Worksheet #15 and #18). Group D analytes (*Giardia* and cryptosporidium) will not be sampled during the low flow/spring tide event. Frequency and type of QC samples are provided in Worksheet #20.

High Flow Events. Two High Flow Events are proposed under storm-induced high flow (i.e., not sustained high flow) conditions (>3,000 cfs at Dundee Dam). The sample locations will include the LPRSA (including the LPRSA tributaries), above the Dundee Dam, and the NBSA (Worksheet #18). The data collected during the High Flow Events will provide data to support the EPCs for the RAs and FWM. The data will also be used to provide the CFT model preliminary information to calibrate and validate the resuspension fluxes from the sediments to the water column, and the subsequent deposition of particle-bound contaminants from the water column to the sediment under conditions where bed sediment is likely to be suspended. It is anticipated that during these events there will be a higher loading of suspended sediments (i.e., more contamination on a per unit weight suspended solids basis may occur since elevated flows associated with storm events will resuspend more bed sediment). One hundred six (106) samples will be collected during each of the High Flow Events to be analyzed for target analytes as defined in Worksheet #15. Group A analytes will be measured during both events. Group B analytes will be measured in one of the two events; it is anticipated that adequate information will be obtained for the model validation from one high flow event. Shallow (3 ft below surface) water stations in the five locations in the lower 17.4 miles of the LPR will be analyzed for pathogens (Worksheet #15 and #18). Group C analytes (coliform bacteria) and Group D analytes (*Giardia* and cryptosporidium) will be sampled during both events. Frequency and type of QC samples are provided in Worksheet #20.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Routine Events						
Newark Bay East – subtidal area midway between Newark Bay South and Newark Bay Northeast, across from Port Newark	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven suspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay Northeast - subtidal area on eastern shore north of Branch Channel and west of Newark Bay North (from PWCM program)	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven resuspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay Northwest – subtidal area on western shore midway between Newark Bay East and Newark Bay Northeast	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven suspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay South – eastern side of shipping channel off southern edge of Elizabeth Port Authority Marine Terminal	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.
Arthur Kill near Arthur Kill Park	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange with the Arthur Kill. Potential estimation of contaminant fluxes between Newark Bay and the Arthur Kill.
Kill van Kull near eastern edge of Mayor Dennis P. Collins Park	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange with the Kill van Kull. Potential estimation of contaminant fluxes between Newark Bay and the Kill van Kull.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Hackensack River north of the Pulaski Skyway	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange with the Hackensack River. Potential estimation of contaminant fluxes between Newark Bay and the Hackensack River.
RM 0	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events Group C in the surface samples in all spring and summer events. Group D in the surface samples in summer events.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange between the LPR and Newark Bay.. Potential estimation of contaminant fluxes between the LPR and Newark Bay at the confluence of the LPR and Newark Bay. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 1.4	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events Group C in the surface samples in all spring and summer events. Group D in the surface samples in summer events.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the salt wedge. Potential estimation of contaminant fluxes to and from Newark Bay at a point in the LPR that is generally located within the salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 6.7 [Tidal 1 if flow is < 1,000 cfs at Dundee Dam[d]]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events Group C in the surface sample in all spring and summer events. Group D in the surface samples in summer events.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics at the upper limit of the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Location is flow-dependent. Provides estimation of chemical concentrations at edge of salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 4.2 [Tidal 2 if flow is < 1,000 cfs at Dundee Dam[e]]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events Group C in the surface samples in all spring and summer events. Group D in the surface samples in summer events.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Location is flow-dependent. Provides estimation of chemical concentrations at midpoint of reach of the salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 10.2 [RM 13.5 if flow < 250 cfs at Dundee Dam]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events Group C in the surface samples in all spring and summer events. Group D in the surface samples in summer events.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics above the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Location is flow-dependent. Provides estimation of chemical concentrations in upper freshwater zone of the river. Provides data for freshwater reach of LPR for ERA and HHRA exposures.
Above Dundee Dam	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from upstream. Provides data for upstream freshwater reach of LPR for ERA and HHRA exposures.

Quality Assurance Project Plan

RI Water Column Monitoring/Small Volume Chemical Data Collection
Lower Passaic River Restoration Project
New Jersey

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Saddle River-Saddle River Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.
Second River-Washington Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Third River-River Road	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in all events Group B in one spring and two summer events	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
High Flow Events						
Newark Bay East – subtidal area midway between Newark Bay South and Newark Bay Northeast, across from Port Newark	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven resuspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay Northeast - subtidal area on eastern shore north of Branch Channel and west of Newark Bay North (from PWCM program)	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven suspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay Northwest – subtidal area on western shore midway between Newark Bay East and Newark Bay Northeast	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay where wind-driven suspension may occur. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Newark Bay South – eastern side of shipping channel off southern edge of Elizabeth Port Authority Marine Terminal	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within Newark Bay. Potential estimation of contaminant fluxes within, to, and from Newark Bay. Provides data for NBSA RAs and, when compared to data from other stations, information to characterize potential concentration gradients of COPCs in the bay.
Arthur Kill near Arthur Kill Park	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Two samples: One High Slack One Low Slack	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange with the Arthur Kill. Potential estimation of contaminant fluxes between Newark Bay and the Arthur Kill.
Kill van Kull near eastern edge of Mayor Dennis P. Collins Park	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Two samples: One High Slack One Low Slack	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange with the Kill van Kull. Potential estimation of contaminant fluxes between Newark Bay and the Kill van Kull.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Hackensack River north of the Pulaski Skyway	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation-exchange with the Hackensack River. Potential estimation of contaminant fluxes between Newark Bay and the Hackensack River.
RM 0	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event Group C in the surface samples in both events. Group D in the surface samples in both events.	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation - exchange between the LPR and Newark Bay. Potential estimation of contaminant fluxes between the LPR and Newark Bay at the confluence of the LPR and Newark Bay. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 1.4	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event Group C in the surface samples in both events. Group D in the surface samples in both events.	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the salt wedge. Potential estimation of contaminant fluxes to and from Newark Bay estimated to be within the salt water wedge even at high flows. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 4.2	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event Group C in the surface samples in both events. Group D in the surface samples in both events.	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the typical salt wedge. Potential estimation of contaminant fluxes within LPRSA. Provides estimation of chemical concentrations at a point typically at midpoint of reach of the salt water wedge, but likely to be upstream of salt water wedge during high flows. Provides data from the LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 6.7	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event Group C in the surface samples in both events. Group D in the surface samples in both events.	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation - dynamics at the typical upper limit of the salt wedge. Potential estimation of contaminant fluxes within LPRSA. Provides estimation of chemical concentrations at a location typically at the upper reach of the salt water wedge, but likely to be upstream of salt water wedge during high flows. Provides data from LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 10.2	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A in both events Group B in one event Group C in the surface samples in both events. Group D in the surface samples in both events.	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics above the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Provides estimation of chemical concentrations in upper freshwater zone of the river. Provides data for freshwater reach of LPR for ERA and HHRA exposures.
Above Dundee Dam	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Six samples: Samples to be collected spaced throughout the predicted storm hydrograph: three on rising limb, one near peak, two on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from upstream. Provides data for upstream freshwater reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Saddle River-Saddle River Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.
Second River-Washington Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Third River-River Road	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A in both events Group B in one event	Four samples: Samples to be collected spaced throughout the predicted storm hydrograph: two on rising limb, one near peak, one on falling limb.	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.
Low Flow/Spring Tide Event						
RM 0	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A, B and C. Group C in the surface sample only.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – exchange between the LPR and Newark Bay. Potential estimation of contaminant fluxes between the LPR and Newark Bay at the confluence of the LPR and Newark Bay. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
RM 1.4	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A, B and C. Group C in the surface sample only.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the salt wedge. Potential estimation of contaminant fluxes between the LPR and Newark Bay within the salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.
Tidal 1[d]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A, B and C. Group C in the surface sample only.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics at the upper end of the salt wedge. Potential estimation of sediment fluxes within the LPRSA. Location is flow-dependent. Provides estimation of chemical concentrations at edge of salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Tidal 2[e]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A, B and C. Group C in the surface sample only.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics within the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Location is flow-dependent. Provides estimation of chemical concentrations at midpoint of reach of the salt water wedge. Provides data for salt water reach of LPR for ERA and HHRA exposures.
RM 10.2 [RM 13.5 if flow < 250 cfs at Dundee Dam]	Water	Two: 3 ft below surface 3 ft from bottom	Target Analytes. See Worksheet #15 Group A, B and C. Group C in the surface sample only.	Four samples: One High Slack One Maximum Ebb Tide One Low Slack One Maximum Flood Tide	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – dynamics above the salt wedge. Potential estimation of contaminant fluxes within the LPRSA. Provides estimation of chemical concentrations in upper freshwater zone of the river. Provides data for freshwater reach of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Above Dundee Dam	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A and B	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from upstream. Provides data for upstream freshwater reach of LPR for ERA and HHRA exposures.
Saddle River-Saddle River Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A and B	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

Sampling Location[a]	Matrix	Depth Intervals	Analyses	Number of Samples per Depth Interval: Number per Flow or Tidal Stage[b,c]	Sampling SOP Reference	Rationale for Sampling Location
Second River-Washington Avenue Bridge	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A and B	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.
Third River-River Road	Water	One: Mid-depth	Target Analytes. See Worksheet #15 Group A and B	One sample: Independent of tide, but quasi-synoptic with other stations	LPR-FI-04 LPR-FI-05 LPR-FI-06	Data to support CFT model calibration and validation – loadings to the LPR. Potential estimation of contaminant fluxes to the LPRSA from the watershed. Provides data for tributaries of LPR for ERA and HHRA exposures.

a Specific locations can be found in Appendix A, Figure 1 and Exhibit 1.

b The number of samples collected per depth in the Routine and Low Flow/Spring Tide sampling events may be modified for some stations pending review of data from the first two events. Should data collected in the four intervals (i.e., high water slack tide, low water slack tide, maximum ebb tide and maximum flood tide) have low variability, this will be reviewed with USEPA and its modeling team to determine if sampling only high water slack tide and low water slack tide will achieve the PQOs.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table

[c] The number of stations in Newark Bay may be modified pending review of data from the first event. Should data collected from the stations indicate low variability between Newark Bay stations, this will be reviewed with USEPA and its modeling team to determine if fewer locations will achieve the PQOs.

[d] The location of Tidal 1 (applicable when flows are < 1,000 cfs) is based on the location of the salt wedge. Tidal 1 will be located approximately one mile downstream of the predicted location of the salt wedge. See Exhibit 1 of the FSP Addendum (Appendix A).

[e] The location of Tidal 2 (applicable when flows are < 1,000 cfs) is based on the location of the salt wedge and the location of Tidal 1. Tidal 2 will be located halfway between Tidal 1 and RM 1.4, but not upstream of RM 4.2. See Exhibit 1 of the FSP Addendum (Appendix A).

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	VOCs	Low	C-1, C-2	120 milliliter (mL)	3 x 40mL Volatile Organics Analysis (VOA) vials	4±2°Celsius (C) , hydrochloric acid (HCl) to pH <2, store in the dark	14 days for preparation and analysis
Water	SVOCs	Low	T-7, T-2	2 Liters (L)	2 x 1L amber glass with Polytetrafluoroethylene (PTFE)-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	PAHs (LRMS-SIM)	Low	T-3, T-4	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	OC Pesticides	Low	T-11, T-12	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	7 days to preparation; 40 days from preparation to analysis
Water	PCBs (Homologs and Congeners)	Low	T-5,T-6	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	PCDD/PCDFs	Low	A-1	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C; store in the dark	365 days for preparation and analysis
Water	TAL Metals and Titanium (excludes mercury)	Low	C-3, C-4, C-5, C-6	2 L	2 x 1L plastic[c]	Nitric acid (HNO_3) to pH<2	180 days (6 months) for preparation and analysis
Water	Metals[d], excluding mercury (dissolved)	Low	C-3, C-4, C-5, C-6	2 L	2 x 1L plastic[c]	Field filter (0.45 micron [um]) and preserve with HNO_3 to pH<2	180 days (6 months) for preparation and analysis

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	Low Level Mercury	Low	B-1	500 mL	2 x 250mL PTFE with PTFE-lined lids	4±24±2°C during shipment; Samples must be preserved or analyzed within 48 hours of collection. Samples will be oxidized by addition of 5mL/L BrCl to original sampling container. Oxidation of the sample within the original container will extend the time to preservation to 28 days	90 days to analysis
Water	Low Level Mercury (dissolved)	Low	B-1	500 mL	2 x 250mL PTFE with PTFE-lined lids	Field filter (0.45 um) and 4±2°C during shipment; Samples must be preserved or analyzed within 48 hours of collection. Samples will be oxidized by addition of 5mL/L BrCl to original sampling container. Oxidation of the sample within the original container will extend the time to preservation to 28 days.	90 days to analysis

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	Methyl Mercury	Low	B-2	500 mL	2 x 250mL PTFE with PTFE-lined lids	Preserve at collection with 0.2% (volume to volume [v/v]) 18 Molar (M) sulfuric acid (H_2SO_4); store in the dark; at 4±2°C	6 months to analysis
Water	Methyl Mercury (dissolved)	Low	B-2	500 mL	2 x 250mL PTFE with PTFE-lined lids	Field filter (0.45 um) and preserve at collection with 0.2% (v/v) 18 M H_2SO_4; store in the dark; at 4±2°C	6 months to analysis
Water	Hexavalent Chromium	Low	C-15	250 mL	2 x 125mL plastic	Field filter (0.45 um) and preserve with buffer to pH 9.3-9.7, store at 4±2°C,adjust on receipt if pH not within limits	28 days to analysis
Water	Butyltins	Low	C-8	1 L	1L amber glass with PTFE-lined lid	4±2°C	7 days to preparation, 40 days from preparation to analysis
Water	Ammonia-N	Low	C-9	100 mL	125mL plastic	4±2°C, H_2SO_4 to pH<2	28 days to analysis
Water	Chlorophyll a	Low	C-22	2 L	2 x 1L amber glass with PTFE-lined lid	4±2°C	Ship to the laboratory and filter within 48 hours of collection. Filters must be frozen, stored in the dark, and analyzed within 24 days

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
Water	Cyanide	Low	C-10	500 mL	2 x 250mL glass or plastic	4±2° C, sodium hydroxide (NaOH) to pH > 12	14 days to analysis
Water	TKN	Low	C-12	1 L	1L glass or plastic	4±2°C, H_2SO_4 to pH<2	28 days to analysis
Water	Total Phosphorus	Low	C-11	250 mL	250mL glass or plastic	4±2° C; H_2SO_4 to pH < 2	28 days to analysis
Water	TOC	Low	C-13	120 mL	3 x 40mL amber glass vials with PTFE-lined lids	4±2° C; H_2SO_4 to pH < 2	28 days to analysis
Water	POC/DOC	Low	C-13, C-16	600 mL	3 x 200mL plastic	4±2°C	Ship to the laboratory and filter using a 0.7um glass fiber filter within 48 hours. Filters and filtrates must be analyzed within 28 days
Water	Total Sulfide	Low	C-14	100 mL	125mL plastic	4±2°C , NaOH to pH >9 +/Zinc Acetate	7 days to analysis
Water	SSC	Low	C-17	2 L	Two tared 1-L plastic	4±2°C; store in the dark; weigh entire sample bottle to nearest 0.1 g and record weight upon receipt at laboratory	28 days to analysis
Water	TDS	Low	C-19	400 mL	2 x 250mL glass or plastic	4±2°C	7 days to analysis
Water	Alkalinity	Low	C-20	400 mL	2 x 250mL glass or	4±2°C	14 days to analysis

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/ analysis)
					plastic		
Water	Sulfate, Chloride	Low	C-21	50 mL	125mL glass or plastic	4±2°C	28 days to analysis
Water	Bacteria	Low	E-1, E-2, E-3, E-4	400 mL	4 x 125mL glass or plastic sterile containers	1-10°C	6 hours to analysis
Water	Protozoans	Low	S-1	1-10L[e]	1 x 10L carboy	1-20°C	96 hours from collection to filtration

[a] Refer to Worksheet #23 for SOP titles and methods

[b] Sample size is the minimum requested by each laboratory to perform the requested analysis; minimum sample size requirements reflect the additional sample needed to permit re-extraction and re-analysis . Additional sample volume is needed for field QC samples (e.g., matrix spikes).

[c] High or low density polyethylene or polypropylene plastics will be acceptable.

[d] Metals to be analyzed in filtered samples are arsenic, cadmium, chromium, copper, lead, nickel, selenium, and zinc.

[e] Exact sample size collected and filtered is dependent on suspended sediment concentration.

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference [a]	No. of Sampling Locations (No. of Samples)	No. of Field Replicates[b]	No. of Rinsate Blanks [c]	No. of Trip Blanks[d]	No. of PE Sample[e]	Total No. of Samples to Lab
Water	VOCs	Low	C-1, C-2	16[f] (450)	23	32	20	5	530
Water	SVOCs	Low	T-7, T-2	16[f] (450)	23	32	NA	5	510
Water	PAHs and Alkyl PAHs - LRMS-SIM	Low	T-3, T-4	16[f] (450)	23	32	NA	5	510
Water	OC Pesticides	Low	T-11, T-12	16[f] (450)	23	32	NA	9	514
Water	PCBs (Homologs and Congeners)	Low	T-5, T-6	16[f] (756)	38	32	NA	9	835
Water	PCDD/PCDFs	Low	A-1	16[f] (756)	38	32	NA	9	835
Water	Alkalinity	Low	C-20	16[f] (756)	38	32	NA	0	826
Water	SSC	Low	C-17	16[f] (756)	38	32	NA	NA	826
Water	TAL Metals (excluding mercury, cadmium, copper and lead), Titanium, hardness (by calculation)	Low	C-3, C-4, C-5, C-6, C-18	16[f] (450)	23	32	NA	10[g]	515
Water	Cadmium, copper and lead	Low	C-3, C-4, C-5, C-6	16[f] (756)	38	32	NA	10[g]	836
Water	Metals (dissolved) (excluding mercury, cadmium, copper and lead)	Low	C-3, C-4, C-5, C-6	16[f] (450)	23	32	NA	NA[g]	505
Water	Cadmium, copper and lead (dissolved)	Low	C-3, C-4, C-5, C-6	16[f] (756)	38	32	NA	NA[g]	826
Water	Sulfate and Chloride	Low	C-21	16[f] (756)	38	32	NA	0	826

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference [a]	No. of Sampling Locations (No. of Samples)	No. of Field Replicates[b]	No. of Rinsate Blanks [c]	No. of Trip Blanks[d]	No. of PE Sample[e]	Total No. of Samples to Lab
Water	Low Level Mercury	Low	B-1	16[f] (756)	38	32	NA	5	831
Water	Low Level Mercury (dissolved)	Low	B-1	16[f] (756)	38	32	NA	NA	826
Water	Methyl Mercury	Low	B-2	16[f] (450)	23	32	NA	5	510
Water	Methyl Mercury (dissolved)	Low	B-2	16[f] (450)	23	32	NA	NA	505
Water	Hexavalent Chromium	Low	C-15	16[f] (450)	23	32	NA	5	510
Water	Butyltins	Low	C-7, C-8	16[f] (450)	23	32	NA	5	510
Water	Bacteria	Low	E-1, E-2, E-3, E-4	5[f] (35)	2	8	NA	NA	45
Water	Protozoans	Low	S-1	5[f] (20)	2	NA	NA	0	22
Water	Ammonia-N	Low	C-9	16[f] (450)	23	32	NA	0	505
Water	Cyanide	Low	C-10	16[f] (450)	23	32	NA	0	505
Water	TKN	Low	C-12	16[f] (450)	23	32	NA	0	505
Water	Total Phosphorus	Low	C-11	16[f] (450)	23	32	NA	0	505
Water	TOC	Low	C-13	16[f] (756)	38	32	NA	0	826
Water	DOC	Low	C-13	16[f] (756)	38	32	NA	0	826
Water	POC	Low	C-16	16[f] (756)	38	32	NA	NA	826
Water	Total Sulfide	Low	C-14	16[f] (756)	38	32	NA	0	826
Water	TDS	Low	C-19	16[f] (756)	38	32	NA	0	826
Water	Chlorophyll a	Low	C-22	16[f] (756)	38	32	NA	1	827

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

a. Refer to Worksheet #23 for SOP title and method

b. Field duplicates will be collected at a frequency of 1 per 20 samples unless noted otherwise.

c. Equipment rinsate blanks will be collected at a frequency of one per sampling event per sampling team for each set of decontaminated equipment utilized for a particular task. The total number of rinsate blanks is estimated based on details in Worksheet #18 and the FSP Addendum and may change as the program progresses. This estimate assumes four teams per eight events.

d. Trip blanks will be associated with VOCs. One trip blank per analyses will be included in each cooler transporting samples for these analyses to the respective laboratories; the number in this column is therefore an estimate and assumes VOCs will be collected each of the 4 days in the 5 events where Group B analytes are collected.

e. PE (also known as Proficiency Testing) Samples for the program will be obtained from R.T.Corporation. Refer to Worksheet #31 for a description of the PE program for the CWCM. This total includes certified reference material (CRM) and Quality Control Check Samples (QCCS) samples that will be analyzed at laboratories as part of their method or on-going QC programs, as well as the pre-program PE samples.

f. Refer to Worksheet #18 and the FSP Addendum for details of sampling locations and monitoring event schedule. Sampling locations will vary based on tide stage and river flow for two tidal stations during the Routine (flows < 1,000 cfs at Dundee Dam) and Low Flow/Spring Tide Events. The number of stations per event is fixed at 16 for Routine Events (when flows > 1,000 cfs at Dundee Dam) and for High Flow Events. When flows are < 1,000 cfs at Dundee Dam, two stations within the LPRSA (Tidal 1 and Tidal 2) may move, based on the location of the salt wedge. See FSP Addendum Exhibit 1 (Appendix A).

g. PE samples for both freshwater and saltwater matrices. Metals PE samples will be analyzed for total metals only.

QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table

The following is a list of all SOPs associated with project sampling including, but not limited to, sample collection, field measurements, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
LPR-G-01	Field Records, Rev. 7	AECOM	NA	No	Appendix B
LPR-G-02	Navigation/Positioning, Rev. 5	AECOM	Differential Global Positioning System (dGPS)	No	Appendix B
LPR-G-03	Equipment Decontamination, Rev. 5	AECOM	Various – see Appendix B	No	Appendix B
LPR-G-04	Investigation Derived Waste (IDW) Handling and Disposal, Rev. 5	AECOM	Various – see Appendix B	No	Appendix B
LPR-G-05	Sample Custody, Rev. 6	AECOM	NA	No	Appendix B
LPR-G-06	Packaging and Shipping, Rev. 5	AECOM	NA	No	Appendix B
LPR-FI-04	Small Volume Surface Water Sampling/Chemical Data Collection, Rev. 2	AECOM	Peristaltic pump, trigger-activated bottle sampler	No	Appendix B
LPR-FI-05	Water Column Profiling, Rev. 2	AECOM	Datasonde	No	Appendix B
LPR-FI-06	Small Volume Surface Water Sampling for Trace Metals, Rev. 2	AECOM	Peristaltic pump	No	Appendix B

Procedural modifications to these documents may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification will be approved in advance by the Project QA Manager, CWCM Task Manager, the CPG Coordinator and the USEPA RPM. Deviations will be documented in the field records.

QAPP Worksheet #22 (UFP-QAPP Manual Section 3.1.2.4) Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[1]
YSI	Temperature sensors are factory calibrated. Conductivity, pH, salinity are calibrated against fixed calibration solutions. Dissolved oxygen calibrated in air.	Battery checks performed every morning before use, and charged every evening after use. All probes will be kept clean of debris and membranes free of tears.	Calibrate per manufacturer's specifications (Section 2.6 of manual, provided with equipment).	Daily for functionality	Daily or recalibrate as needed	Dissolved Oxygen goal is ± 0.5 mg/L of saturation in air. pH goal is ± 0.3 with buffer solutions Conductivity goal is ±10% of standard. Salinity goal is ± 10% of standard.	Recalibrated or replaced	AECOM FTM or designee	LPR-FI-05

[1]Refer to the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-1	EPA 8260B [d]	Volatile Organic Compounds by GC/MS, VOC 8260, Rev. 14, 11/20/2009	Definitive	Organics (VOCs Analysis)	GC/MS	CAS-Kelso, WA	Y, Use low standard to reduce QL.
C-2	EPA 5030[d]	Purge and Trap for Aqueous Samples, VOC-5030, Rev.4, 4/3/2007	Definitive	Organics (VOCs Sample Preparation)	P&T	CAS-Kelso, WA	N
T-2	EPA 8270C [d]	Semivolatile Organic Analysis by GC/MS: Method(s): SW-846 8270C and EPA 625, PT-MS-001, Rev.11,11/17/2009	Definitive	Organics (SVOCs)	GC/MS	TestAmerica-Pittsburgh, PA	N
T-3	EPA 3520C [d]	Extraction of Selected Semivolatile Organic Compounds and Alkylated PAHs for Analysis by GC/MS-SIM, KNOX-OP-0023, Rev. 0, 1/12/2010	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Knoxville, TN	Y, Cleanup by Gel Permeation Cleanup (GPC) and silica gel
C-3	EPA 3010A [d]	Metals Digestion, MET-3010A, Rev. 10, 7/12/2007	Definitive	Metals (Sample Preparation-Aqueous)	N/A	CAS-Kelso, WA	N
T-4	CARB 429[e]	Isotope Dilution Analysis of Selected Semivolatile Organic Compounds and Alkylated PAHs by Gas Chromatography/Mass Spectrometry-Selected Ion Monitoring (GC/MS-SIM), KNOX-ID-0016, Rev. 8, 8/13/2010	Definitive	Organics (PAHs)	High Resolution Gas Chromatography, Low Resolution Mass Spectrometry via Selected Ion Monitoring (HRGC/LRMS-SIM)	TestAmerica-Knoxville, TN	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
T-5	EPA 1668A [f]	Extraction of Polychlorinated Biphenyl (PCB) Isomers for Analysis by Isotope Dilution HRGC/HRMS, KNOX-OP-0021, Rev. 1, 2/1/2011	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Knoxville, TN	N
T-6	EPA 1668A [f]	Analysis of Polychlorinated Biphenyl (PCB) Isomers by Isotope Dilution HRGC/HRMS, KNOX-ID-0013, Rev. 9, 1/7/2010	Definitive	Organics (PCB Congeners)	HRGC/ High Resolution Mass Spectrometry (HRMS)	TestAmerica-Knoxville	N
T-7	EPA 3520C [d]	Extraction and Cleanup of Organic Compounds from Waters Solids, Tissues and Wipes, PT-OP-001, Rev. 13, 3/11/2011	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Pittsburgh, PA	N
T-11	EPA 1699 [f]	Analysis of Organochlorine Pesticides By High Resolution Gas Chromatography/High Resolution Mass Spectrometry, WS-ID-0014, Rev. 5.3, 11/17/2010	Definitive	Organics (OC Pesticides)	HRGC/HRMS	TestAmerica-West Sacramento, CA	Y, Deactivated silica gel cleanup (described in method) required, reference method QC criteria, rather than SOP limits, must be used to flag exceedances in the report narrative

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-4	EPA 6010C [d]	Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), MET-ICP, Rev. 22, 7/30/2010	Definitive	Metals	ICP/AES	CAS-Kelso, WA	N
T-12	EPA 3640A [d]	Gel Permeation Cleanup [Method 3640A], WS-OP-0012, Rev. 4, 10/5/2007	Definitive	Organics (OC Pesticides)	GPC	TestAmerica-West Sacramento, CA	N
C-5	EPA 6020A [d]	Determination of Metals and Trace Elements by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), EPA Method 6020, MET-6020, Rev. 14, 4/10/2010	Definitive	Metals	ICP/MS	CAS-Kelso, WA	N
C-6[g]	EPA 1640[f]	Trace Metals in Water by Pre-Concentration Using Reductive Precipitation Followed by ICP-MS Analysis, MET-RPMS, Rev. 5, 2/14/08	Definitive	Metals (Sample Preparation)	N/A	CAS-Kelso, WA	N
C-7	Krone[h]	Extraction of Organotins in Sediment, Water, and Tissue Matrices, EXT-OSWT, Rev. 6, 11/25/2009	Definitive	Organics (Sample Preparation)	N/A	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-8	Krone[h]	Butyltins, SOC-BUTYL, Rev. 9, 10/2/2009	Definitive	Organics (Butyltin)	GC/Flame Photoionization Detector (FPD)	CAS-Kelso, WA	N
C-9	SM 4500-NH3G[i]	Ammonia by Flow Injection Analysis, GEN-350.1, Rev. 8, 4/13/2010	Definitive	General Chemistry	Rapid Flow Analyzer Colorimeter	CAS-Kelso, WA	N
C-10	EPA 335.2[j]	Total Cyanides and Cyanides Amenable to Chlorination, GEN-CN, Rev. 16, 12/30/2010	Definitive	General Chemistry	Lachat Quik-Chem Analyzer	CAS-Kelso, WA	N
C-11	EPA 365.3[j]	Phosphorus Determination Using Colorimetric Procedure, GEN-365.3, Rev. 10, 8/28/2008	Definitive	General Chemistry	Ultraviolet-Visible Spectrophotometry (UV-VIS)	CAS-Kelso, WA	N
C-12	ASTM D 3590/ D 1426[k]	Nitrogen, Total and Soluble Kjeldahl, GEN-TKN, Rev. 10, 1/7/2008	Definitive	General Chemistry	Ion Selective Electrode	CAS-Kelso, WA	N
C-13	SM 5310C[i]	Total Organic Carbon in Water, GEN-TOC, Rev. 11, 2/19/2010	Definitive	General Chemistry	TOC Analyzer (Persulfate Oxidation Method)	CAS-Kelso, WA	N, note DOC and POC will be performed on samples from the same container
C-14	SM 4500-S2F[i]	Total Sulfides by Methylene Blue Determination, GEN-9030, Rev. 10, 1/7/2010	Definitive	General Chemistry	UV-VIS	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-15	EPA 218.6[l]	Hexavalent Chromium by Ion Chromatography, GEN-7199, Rev. 3, 1/13/2011	Definitive	Metals	Ion Chromatography	CAS-Rochester, NY	N, use of low level method option required
A-1	EPA 1613B[l]	Polychlorinated Dibenzodioxin/ Furans USEPA Methods 8290,1613, 23, 0023A, and TO-9A, AP-CM-5, Rev.15, 9/02/2010	Definitive	Organics (PCDD/PCDFs)	Isotope Dilution Mass Spectrometry	Analytical Perspectives, NC	N
A-2	EPA 1613B[l]	PCDD/Fs in Water by SPE AP-SP-E5, Rev.10, 10/12/2008	Definitive	Organics (Sample Preparation)	N/A	Analytical Perspectives, NC	N
B-1	EPA 1631[l]	Procedure for EPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, BR-0006, Rev. 004e, 5/24/2010	Definitive	Metals (Total Low Level Mercury)	Cold Vapor Atomic Fluorescence (CVAFS)	Brooks Rand-Seattle, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
B-2	EPA 1630[f]	Determination of Methyl Mercury by Aqueous Phase Ethylation, Trap Pre-Collection, Isothermal GC Separation, and CVAFS Detection: BRL Procedure for EPA Method 1630 (Aqueous Samples) and EPA Method 1630, Modified (Solid Samples), BR-0011, Rev. 013c, 5/24/2010	Definitive	Metals (Methyl Mercury)	CVAFS	Brooks Rand-Seattle, WA	N
C-16	EPA 440[m]	Sample Preparation for Particulate Carbon and Nitrogen and Particulate Organic Carbon in Water by Combustion / Thermo-Conductivity or Infrared Detection, GEN-PC PN POC PREP, Rev. 01, 7/3/09	Definitive	General Chemistry	TOC Analyzer	CAS-Tucson, AZ	N, note the nominal pore size of the GF/F filter used must be 0.7 um. POC and DOC will be performed on sample from the same container,
C-17	ASTM D 3977 [k]	Standard Test Methods for Determining Sediment Concentration in Water Samples, GEN-3977, Rev. 0, 7/11/2011	Definitive	General Chemistry	Gravimetric	CAS-Kelso, WA	N, Note Test Option B without the 14 day settling time will be used
C-18	SM 2340B[i]	Hardness, Total, GEN-2340, Rev. 7,12/18/2009	Definitive	General Chemistry	Calculation	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
C-19	SM 2540C[i]	Solids, Total Dissolved (TDS), GEN-TDS, Rev. 8, 3/19/2010	Definitive	General Chemistry	Gravimetric	CAS-Kelso, WA	N
C-20	SM 2320B[i]	Alkalinity, Total, GEN-2320, Rev. 7, 3/1/2010	Definitive	General Chemistry	Titrimetric	CAS-Kelso, WA	N
C-21	EPA 9056A [d]	Ion Chromatography, GEN-IONC, Rev.14, 3/1/2010	Definitive	General Chemistry	Ion Chromatography (IC)	CAS-Kelso, WA	N
C-22	SM 10200-H[i]	Chlorophyll a by Colorimetry, GEN-CHLOR, Rev. 0, 5/25/2010	Definitive	General Chemistry	UV-VIS Spectrophotometer	CAS-Kelso, WA	N
E-1	SM 9223B[i]	Chromogenic Substrate Coliform Test – Colilert, M017, Rev. 4, 3/10/2010	Definitive	Microbiological (Bacteria)	Incubator, Ultraviolet Lamp, Thermometer, pH Meter	EMSL, NJ	N
E-2	SM 9222D[i]	Standard Operating Procedure for Fecal Coliform by Membrane Filtration, M019, Rev.1.3, 1/1/2008	Definitive	Microbiological (Bacteria)	Incubator, Thermometer, pH Meter	EMSL, NJ	N
E-3	SM 9230C[i]	Standard Operating Procedure for the Detection and Enumeration of Fecal Streptococci in Water by Membrane Filtration Using m-Enterococcus Agar, M020, Rev.1.2, 3/1/2006	Definitive	Microbiological (Bacteria)	Incubator, Thermometer, pH Meter	EMSL, NJ	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number	Primary Method Reference[b]	Laboratory SOP[c] Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instruments	Organization Performing Analysis	Modified for Project work? (Y/N)
E-4	SM 9230C[i]	Standard Operating Procedure for The Detection and Enumeration of *Enterococci* in Water by Membrane Filtration Using membrane-Enterococcus-Esculin Iron Agar (mE-EIA), M029, Rev.1.1 3/1/2006	Definitive	Microbiological (Bacteria)	Incubator, Thermometer, pH Meter	EMSL, NJ	N
S-1	EPA 1623[f]	Standard Operating Procedure for Method 1623: Cryptosporidium and Giardia in Water by Filtration/IMS/FA, Modified for Special Project Water Matrices and Use of Colorseed™, ASI SOP No. ASI224-8, Rev. 0, 9/10/2010	Definitive	Microbiological (Protozoa)	Microscope	Analytical Services, Inc., VT	Y, Section 9.3.5.10 is modified to add the following two sentences: "Leave the slides on the slide warmer for approximately 10 minutes after all slides are visibly dry. Place the slides on a tray and place in incubator (41.0 +/- 1.0 deg. C for 15 +/- 1 minutes)."

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

a All SOPs are contained in Appendix C-1.

b Complete references are provided in Attachment 1.

c It is expected that the procedures outlined in these SOPs will be followed. Procedural modifications to individual SOPs may be warranted depending upon an individual sample matrix, interferences encountered, or limitations imposed by the procedure. Deviations from individual SOPs will be documented in the laboratory records. Substantive modification to any SOP will be approved in advance by the Project QA Manager and CWCM Task Manager and communicated to the CPG Coordinator and to the USEPA Remedial Project Manager for pre-approval before implementation. Examples of substantive modifications include changes to QA/QC requirements or control limits, changes other than required dilutions that affect sensitivity, and any changes that adversely affect the selectivity of the analyte detection. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity. Note the laboratory SOPs may contain default control limits, which are superceded by statistically derived control limits. If current statistically derived QC control limits are available; these current QC control limits are presented in Worksheet #12 and Worksheet #28 in place of the default limits presented in the SOPs, or presented in Attachment C-2 and incorporated by reference. Note laboratory updates to statistical control limits may occur during program execution.

d USEPA 2008a

e CARB 1997

f USEPA 2010b

g This SOP will be used for the applicable elements when sample salinity exceeds 1/20 that of seawater in order to avoid dilutions and improve sensitivity.

h Krone,C.A. *et al* 1988

I APHA 1998

j USEPA 1983

k ASTM 2010

l USEPA 2010a

m USEPA 1997

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
GC/MS (VOC)	Bromofluorobenzene (BFB) tune; Initial and Continuing Calibration as Required in SOP	Verify tuning every 12 hours; initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met.	Initial calibration (ICAL) % RSD ≤30% for Calibration Check Compound (CCCs); ICAL % RSD ≤15% or linear curve r≥ 0.995, or quadratic curve r^2≥0.990. Initial Calibration Verification (ICV) and Continuing calibration verification (CCV) percent deviation (%D) ≤20% for CCCs; system performance check compounds (SPCC) minimum average Response factors (RF).	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-1
GC/MS (SVOC)	Decafluorotriphenylphosphine (DFTPP) tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours; Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met.	ICAL %RSD ≤30% for CCCs; ICAL %RSD ≤15% or linear curve r ≥ 0.995, or quadratic curve r^2 ≥0.990. CCV %D ≤20% for CCCs; SPCC minimum avg. RF is 0.050	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-2

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
LRMS-SIM (PAH and Alkyl PAHs)	DFTPP tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours using perfluorotributylamine; Initial calibration after instrument set up, after major maintenance, and/or instrument changes have occurred	ICAL %RSD ≤30% CCV %D ≤30%. ICV %D ≤30%.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-4
HRGC/HRMS (OC Pesticides)	Instrument tuning, initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major maintenance and/or instrument changes have occurred. Calibration verification minimum every 12 hours	RSD for mean relative response factors (RRF) calibrated by isotope dilution ≤ 20%; all other compounds ≤ 30%; initial calibration verification (ICV) ≤ 30% of true value. Refer to Appendix C-2 for internal precision recovery (IPR) and calibration verification (VER) criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-11

Quality Assurance Project Plan

RI Water Column Monitoring/Small Volume Chemical Data Collection
Lower Passaic River Restoration Project
New Jersey

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
HRGC/HRMS (PCB Congeners and Homologs)	Retention time calibration, initial calibration, continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification minimum every 12 hours	ICAL %RSD $\leq$ 20% for target analytes calculated by isotope dilution. ICV %D < 50% for all targets and <35% for all but 4 target analytes %RSD $\leq$ 35% for target analytes calculated by internal standard. CCV $\leq$ 30% Drift for Toxics and LOC congeners CCV 40-160% for non-Toxic congeners. Refer to Appendix C-2 for IPR and VER criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	T-6
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Perfluorokerosene (PFK) Tune; initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Continuing calibration minimum every 12 hours	%RSD for mean response of unlabeled standards $\leq$ 10%; labeled reference compounds ± 20% Continuing calibration using Batch Control Spike (BCS_3) per SOP. Refer to Appendix C-2 for IPR criteria.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	A-1

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
ICP/AES (Metals)	Initial and continuing calibration per SOP	Profile instrument; Copper/Manganese (Cu/Mn) ratio daily; blank, RL and high standard daily; Interference Check Sample (ICS) at start and every 8 hours; Continuous calibration check (CCB), CCV every 10 samples	Cu/Mn ratio within 20% of value at time interelement corrections (IECs) determined. ICV, CCV ± 10% of true value; ICSAB ± 20% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-4
ICP/MS (Metals)	Initial and continuing calibration per SOP	Intensity check, Cu/Mn ratio ; blank, RL and high standard daily; ICS at start and every 8 hours; CCB, CCV every 10 samples	Cu/Mn ratio within 20% of value at time IECs determined. ICV, CCV ± 10% of true value; ICSAB ± 20% of true value; mass spectrometer tuning criteria per SOP C-5	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-5
CVAFS (Mercury)	Initial and continuing calibration per SOP	Calibrate daily with a calibration blanks (CB) (1 per split bottle/bubbler used), minimum of 5 standards, and ICV daily. Analyze CCV every 10 samples. Analyze carryover blank following any result ≥20,000 pg.	CB: each ≤40 pg; average ≤20 pg; standard deviation ≤7.5 pg ICV 85 -115% CCV 77-123% (total mercury) Carryover blank: ≤40 pg and within ± 20 pg of average CB	Inspect system, correct problem, rerun calibration and affected samples	Analyst	B-1

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
CVAFS (Methyl Mercury)	Initial and continuing calibration per SOP	Calibrate daily with ethylation blanks, minimum of 5 standards, and ICV daily. Analyze CCV every 10 samples. Analyze carryover blank following any result ≥2x the concentration of the high calibration standard	Ethylation Blank: <QL ICV 80 -120% CCV 67 -133% Carryover blank: <QL IPR and OPR criteria per reference method	Inspect system, correct problem, rerun calibration and affected samples	Analyst	B-2
IC (Hexavalent Chromium, Sulfate, Chloride)	Initial and continuing calibration per SOP	Calibrate daily using a minimum of a blank and 3 standards; r ≥ 0.999; CCB, CCV every 10 samples	ICV, CCV ± 10% of true value; CCB <QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-15, C-21
GC/FPD (Butyltins)	Initial and continuing calibration per SOP	External calibration prior to each use; continuing calibration every 10 injections or every 12 hours whichever is more frequent	ICAL RSD <20% ICV, CCV ± 25% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-8
UV-VIS (Sulfides and Chlorophyll a)	Initial and continuing calibration per SOP	Allow spectrophotometer to warm up for 30 minutes. External calibration prior to each use; r ≥ 0.995; CCB, CCV every 10 samples	ICV, CCV ± 10% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-14, C-22
Rapid Flow Analyzer Colorimeter (Ammonia-N)	Initial and continuing calibration per SOP	Determine Linear Calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r ≥ 0.995; CCB, CCV every 10 samples	Linearity check must be within ± 10% of original values; CCB <QL; ICV, CCV ± 10% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-9

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
Automated Ion Rapid Flow Analyzer (Cyanide)	Initial and continuing calibration per SOP	Determine Linear Calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r > 0.995; CCB, CCV every 10 samples	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-10
Ion Selective Electrode (TKN)	Initial and continuing calibration per SOP	Calibrate daily, ICV, CCV and CCB every 10 samples	ICV, CCV ± 10% of true value; CCB <QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-12
UV-VIS (Phosphorus)	Initial and continuing calibration per SOP	External calibration prior to each use; r ≥ 0.995; CCB, CCV every 10 samples	ICV, CCV ± 10% of true value; CCB <QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-11
TOC Analyzer	Initial and continuing calibration per SOP	CCV each batch	ICAL linearity $r^2 \geq 0.995$ ICV +/- 10% true value CCV+/- 10% true value.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-13, C-16
Analytical Balance (TDS, SSC)	Daily	Weigh and record National Institute of Standards and Technology (NIST) traceable standard weights in range of interest	± 5% of certified weight	Inspect system, correct problem, recalibrate	Analyst	C-17, C19

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C.

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
GC/MS (VOC and SVOC)	Clean sources and quadrupole rods; maintain vacuum pumps; tune mass spectrometer as needed	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	C-1, T-2
HRGC/LRMS-SIM (PAH and Alkyl PAHs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-4
HRGC/HRMS (OC Pesticides)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-11
HRGC/HRMS (PCB Congeners and Homologs)	Clean sources; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	T-6
Isotope Dilution Mass Spectrometry (PCDD/PCDFs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	A-1

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
ICP/AES (Metals)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-4
ICP/MS (Metals)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-5
CVAFS (Mercury, Methyl Mercury)	Replace disposables, flush lines	Sensitivity check	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	B-1, B-2
IC (Hexavalent Chromium, Sulfate, Chloride)	Replace columns as needed; check eluent and regenerant reservoirs; maintain system pressure	Analytical standards	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-15, C-21
GC/FPD (Butyltins)	Change septa, clean injectors, change or trim columns, install new liners; replace purifier as needed; clean autosampler periodically	Detector signals and chromatogram review	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-8

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
UV-VIS Spectrophotometer (Sulfides, Chlorophyll)	Verify lamp is working; clean cuvettes free of lint and scratches, calibrate spectrophotometer every 6 months by an outside service	Analytical standards	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-14, C-22
Rapid Flow Analyzer Colorimeter (Ammonia-N)	Replace disposables, flush lines	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-9
Automated Ion Analyzer (Cyanide)	Replace disposables, flush lines	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-10
Ion Selective Electrode (TKN)	Replace membrane and filling solution; store electrode in ammonia solution	Verify standardization with solutions as required in SOP	Inspect membrane for signs of failure	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-12
UV-VIS (Phosphorus)	Verify lamp is working	Analytical standards	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-11
TOC Analyzer (TOC, DOC, POC)	Replace disposables, clean quartz boat; oven thermometer calibration quarterly	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-13, C-16

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
Analytical Balance (TDS, SSC)	Clean balance after each use; service annually	NIST Traceable weights	Instrument performance	Daily or as needed	Measured weight within certified tolerance	Clean, verify zero on balance, reweigh; call for service	Analyst or Section Supervisor	C-17, C-19
Microscope (protozoan analysis)	Adjustment and testing of illumination plus optics	Optics testing per method	Optics testing per method	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	S-1

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix C

QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): AECOM Field Team (see Worksheet #21 for a list of the sample collection methods)
Sample Packaging (Personnel/Organization): AECOM Field Team
Coordination of Shipment (Personnel/Organization): AECOM Field Team
Type of Shipment/Carrier: UPS or FedEx for overnight delivery or laboratory courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Custody and Storage (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Preparation (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Determinative Analysis (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples will not be stored in the field but will be shipped to the designated laboratory the same day as collection or no later than the day after collection. If circumstances require that the samples be stored in the field, they will be maintained under the method-specified conditions and preserved according to the requirements of Worksheet#19 (e.g., kept at 4±2° C).
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extraction and digestion holding times are summarized in Worksheet #19.
Biological Sample Storage (No. of days from sample collection): Sample storage times for biological tests are summarized in Worksheet #19.
SAMPLE DISPOSAL
Personnel/Organization: Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services).
Number of Days from Analysis: Varies by laboratory; laboratory is required to give AECOM 30 days notice prior to intent to discard any project samples.

QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) Sample Handling System

Sample Handling and Custody

Sample custody procedures ensure the timely, correct, and complete analysis of each sample for all parameters requested. A sample is considered to be in someone's custody if it:

- Is in his/her possession
- Is in his/her view, after being in his/her possession
- Is in his/her possession and has been placed in a secured location
- Is in a designated secure area

Sample custody documentation provides a written record of sample collection and analysis. The sample custody procedures require the specific identification of samples associated with an exact location and the recording of pertinent information associated with the sample, including time of collection and any preservation techniques, and a chain of custody (COC) record that serves as physical evidence of sample custody. Custody procedures will be similar to the procedures outlined in USACE's *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 2001) and the USEPA's *Contract Laboratory Program Guidance for Field Samplers* (USEPA 2007b). The COC documentation system provides the means to individually identify, track, and monitor each sample from the time of collection through final data reporting. Sample custody procedures are developed for three areas: sample collection, laboratory analysis, and final evidence files, which are described in Worksheet #27 and SOP LPR-G-05 (Appendix B).

Field Sample Handling and Custody

Field records provide a means of recording information for each field activity performed at the site. COC procedures document pertinent sampling data and all transfers of custody until the samples reach the analytical laboratory. The sample packaging and shipment procedures summarized in Worksheet #27 are designed to ensure that the samples arrive at the laboratory with the COC intact. Specific preservation procedures required for each analytical method are described in Worksheet #19.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): The field sample custody procedures including sample packing, shipment, and delivery requirements, are discussed in Worksheet #26. Sample management information is also provided in SOPs LPR-G-05 and LPR-G-06 (Appendix B).

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Each laboratory has a sample custodian who accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies, document sample condition upon receipt at the laboratory and will sign and date all appropriate receiving documents. Additional information on laboratory sample receiving procedures is provided in the text below this summary table.

Sample Identification Procedures: Each sample will be assigned a unique sample identification number using the Lower Passaic River Data Management System. This identification nomenclature will consist of an alphanumeric code that identifies the program, sample location (including depth interval if needed), and sample type. Details of sample identification are provided below.

Chain-of-Custody Procedures: A COC will accompany all samples from the time of sampling through all custody transfers. Samples of the COC form is provided in SOP LPR-G-05 (Appendix B); the COC procedures are summarized below and in SOP LPR-G-05.

Sample Identification

Samples will be uniquely identified at the time of collection. The sample identifiers will be assigned according to the following pattern:

Program-Event-Station-Depth-Type

Where:

Program	Two-digit year plus sequence letter to distinguish sampling programs: “11B” for the first event of the CWCM program, assuming an August 2011 event.
Event	“CE” plus two-digit sequence number: Event will define tide stage or hydrographic period for the sample. It is not linked directly to a survey but a range of event numbers will all belong to one survey (e.g., CE01 may be high slack, CE02 may be low slack, and CE03 may non-tidal during a survey)
Station	“T” plus three-digit representation of RM by tenths” “T014” for station at RM 1.4
Depth	Single character sequence letter for depth interval, with “X” reserved to indicate no depth interval: “A” for first (uppermost) depth interval, “B” for lower depth

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Type	Single character for sample type: “S” for normal sample, “T” for field duplicate, “R” for equipment rinsate blank, “F” for normal field filtered sample, “G” for duplicate of field filtered sample

For example:

- A sample labeled 11B-CE01-T102-AS identifies a CWCM program (11B) sample. The sample was collected during the first sampling event for the CWCM program (CE01) and was collected at RM 10.2. The sample is from the uppermost depth (A) and is identified as a normal sample (S).
- A sample labeled 11B-CE04-T014-BG identifies a CWCM program (11B) sample. The sample was collected during the fourth sampling event for the CWCM program (CE04) and was collected at RM 1.4. The sample is from the lower depth (B) and is identified as a field filtered duplicate sample (G).
- A sample labeled 10D-CE01-T014-XR identifies a CWCM program (10D) sample. The sample was collected during the first sampling event for the CWCM program (CE01) and was collected in conjunction with sampling at RM 1.4. The sample is an equipment blank (XR). Note that although equipment rinsate blanks are assigned an ID related to a sample recently processed or collected, this is for identification purposes only. Equipment rinsate blanks are collected periodically and are considered reflective of decontamination procedures for the period (refer to Worksheet #20). They are therefore applicable to all samples collected during that period of the survey using a particular type of equipment.

Electronic Sensor Data File Naming

The unique naming of sensor data storage and/or configuration files will be assigned similar to the scheme for sample identification. YSI files will be named, at a minimum, with the program, event, and station codes (e.g., 10D-E04-T020) plus the specific collection software-assigned file extension. If more than one file is generated per event at one station, then a sequence character will be included (e.g., 10D-E04-T020-B).

Chain of Custody Procedure

The COC form serves as an official communication to the laboratory detailing the specific analyses required for each sample. The COC record is prepared by the field sample custodian and accompanies samples from the time of sampling through all transfers of custody. The COC will be retained by the laboratory that analyzes and archives the samples. Three copies of the COC are created; one copy is retained in the field and two copies are sent to the laboratory.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Transfer of Custody and Shipment

Sample custody must be maintained from the time of sampling through shipment and receipt at the laboratory. The procedures for custody transfer are outlined in SOP LPR-G-05 (included in Appendix B).

Sample Packaging and Shipping Requirements

Sample custody must be maintained through shipment of samples to the contracted laboratory. All samples will be packaged and shipped at the end of each day unless other arrangements have been made with the laboratory. Samples will be delivered directly to the laboratory by sampling personnel or will be shipped using the procedures outlined in SOP LPR-G-06 (Appendix B).

Laboratory Custody Procedures

Each contracted laboratory will have a SOP that details the procedures used to document sample receipt and custody within the laboratory. The following procedures must be addressed in the laboratory custody SOP:

- Each laboratory must have a designated sample custodian who accepts custody of the samples at the time of delivery to the laboratory and verifies that the information on the sample labels matches the information on the COC. The sample custodian must sign and date all appropriate receiving documents and note any discrepancies in sample documentation as well as the condition of the samples at the time of receipt.
- Once the samples have been accepted by the laboratory, checked, and logged in, they must be maintained in accordance with laboratory custody and security requirements as outlined in the laboratory QMP.
- To ensure traceability of samples during the analytical process the laboratory will assign a sample ID number based on procedures outlined in the laboratory QMP or laboratory SOP.
- The following procedures, at a minimum, must be documented by the laboratory:
  - Sample extraction /preparation
  - Sample analysis
  - Sample disposal
  - Data reduction
  - Data reporting

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

- Laboratory personnel are responsible for sample custody until the samples are returned to the sample custodian.
- When sample analysis and QC procedures are completed, any remaining sample must be stored in accordance with contractual terms. A minimum of 30 days notice must be provided before disposal of any sample. Data sheets, custody documents and all other laboratory records must be retained in accordance with contractual agreements.

Final Evidence Files

Laboratory records including COCs and other sample receiving records, sample preparation and analysis records, and the final data package become part of the laboratory final evidence file and must be retained as required by the contractual agreement. An original copy of the data package and associated electronic deliverable must be provided to AECOM in accordance with the contractual agreement and will be retained by AECOM along with associated field records and other related correspondence.

Final evidence files as retained by AECOM will include, but not be limited to, correspondence (paper and email), plans, contractual documents, maps and drawings, field data, calculations, assessment reports, laboratory deliverables, progress and data reports. This information will be maintained in a secure area according to the procedures outlined in the Lower Passaic River QMP (AECOM 2009). Electronic files will be archived by ddms.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] VOCs
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] C-1, C-2
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization CAS (Kelso)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB/Instrument Blank	1/Prep Batch (≤20 samples)	No target compounds >QL; no common lab contaminants >5x QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target ompounds >QL; no common lab contaminants >5x QL.
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL; no common lab contaminants >5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL
Trip Blank	1 per cooler of VOC samples	No target compounds >QL; no common lab contaminants >5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL
Surrogates	Every sample	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68-117%R Dibromofluoromethane: 73-122%R Toluene-d8: 78-129%R	Check calculations and instrument performance; recalculate, reanalyze	Analyst/Section Supervisor	Accuracy/Bias	1,2-Dichloroethane-d4: 59-127%R 4-Bromofluorobenzene: 68-117%R Dibromofluoromethane: 73-122%R Toluene-d8: 78-129%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
LCS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
MS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
MSD	1/Prep Batch (≤20 samples)	Compound-specific RPDs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	Compound-specific RPDs; see Appendix C-2
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	SVOCs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-2, T-7
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	TestAmerica (Pittsburgh)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL; no common lab contaminants >5x QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed. Report results if sample results >20x blank result or sample results not detected (ND).	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL; no common lab contaminants >5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL; no common lab contaminants >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Surrogates	Every sample	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R	Check calculations and instrument performance; recalculate, reanalyze	Analyst/Section Supervisor	Accuracy/Bias	2-Fluorobiphenyl: 19-107%R 2-Fluorophenol: 10-111%R 2,4,6-Tribromophenol: 16-122%R Nitrobenzene-d5: 23-112%R Phenol-d5: 15-112%R Terphenyl-d14: 10-132%R
LCS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
MS	1/Prep Batch (≤20 samples)	Compound-specific %Rs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
MSD	1/Prep Batch (≤20 samples)	Compound-specific RPDs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	Compound-specific RPDs; see Appendix C-2
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] PAHs and Alkyl PAHs (LRMS-SIM)
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] T-4, T-3
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization TestAmerica (Knoxville)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL.	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL.	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL
Labeled Compounds	Every sample	60-140%R in MB & LCS 30-120%R in field samples	Check calculations. Ensure that instrument performance is acceptable. If signal/noise (S/N) ratio <10, reprepare and reanalyze sample. If S/N ratio >10, flag data	Analyst/Section Supervisor	Accuracy/Bias	60-140%R in MB & LCS 30-120%R in field samples

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
LCS	1/Prep Batch (≤20 samples)	60-140%R	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	60-140%R
MS	1/20 field samples	60-140%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	60-140%R
MSD	1/20 field samples	RPD<30%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	RPD<30%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] OC Pesticides
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] T-11
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization TestAmerica (West Sacramento)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Prep Batch (≤20 samples)	No target compounds >QL.	1) Report results if sample results >10x blank result or sample results ND. 2) If results are <20x blank and if sufficient sample is available, re-extract and reanalyze samples. 3) If insufficient sample is available, reanalyze extracts. 4) Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL.
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL.	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
OPR Sample (equivalent to LCS)	1/Prep Batch (<20 samples)	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%	1) Check calculations. 2) Reanalyze LCS. Repeated reanalysis is acceptable if the failure is attributed to instrument variability. 3) If repeated failures occur on consecutive LCSs for the same analyte, the cause of the failure will be investigated and corrected before any re-extraction is performed. 4) If sufficient sample is available, re-extract and reanalyze samples. 5) If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	50-120%R, except for 4,4'-DDD 24-123%; 2,4'-DDE 24-123%; Endrin Aldehyde 50-170%; Endrin Ketone 50-134%;
MS	1/20 field samples	50-150%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	50-150%R
MSD	1/20 field samples	RPD<30%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	RPD<30%

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Labeled Compounds	Spiked into every sample and QC sample	Per EPA 1699 Table 5	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveals a problem. If S/N <10 for quantitation ion, reprepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	Per EPA 1699 Table 5
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE and QCCS Sample[d]	9	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCBs – Congeners and Homologs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	T-6
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	TestAmerica (Knoxville)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds> QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias Contamination	No target compounds >QL
OPR Sample (equivalent to LCS)	1/Batch (20 samples)	50-150%R Toxics/LOC congeners; 40-160%R all other congeners	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias	50-150%R Toxics/LOC congeners; 40-160%R all other congeners
MS	1/20 field samples	50-150%R Toxics/LOC congeners; 40-160%R all other congeners	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	50-150%R Toxics/LOC congeners; 40-160%R all other congeners

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MSD	1/20 field samples	RPD<30%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	RPD<30%
Labeled Compounds	Spiked into every sample and QC sample.	30-140%R	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal problem. If S/N<10 for the quantitation ion, reprepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	30-140%R
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE and QCCS Sample[d]	9	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	PCDD/PCDFs
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	A-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Analytical Perspectives
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Instrument Blank	Once per 12 hours if MB is not run	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias-Contamination	No target compounds >QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Labeled Compounds	Spiked into every sample and QC sample.	See reference method and SOP for compound specific control limits	Check all calculations for error; ensure that instrument performance is acceptable; recalculate data and/or reanalyze extract if either of above checks reveal a problem. If S/N<10 for quantitation ion, reprepare and reanalyze sample. If S/N>10, flag data.	Analyst/Section Supervisor	Accuracy/Bias	See reference method and SOP for compound specific control limits
BCS_3	1/Batch (20 samples)	%D for RRF vs ICAL $\leq$ 20% except labeled analogs $\leq$ 30%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	%D for RRF vs ICAL $\leq$ 20% except labeled analogs $\leq$ 30%
MS	1/Batch (20 samples)	50-150%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	50-150%R
MSD	1/Batch (20 samples)	RPD$\leq$ 25%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	RPD$\leq$ 25%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE and QCCS Sample[d]	9	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals (total and dissolved): ICP/AES
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	C-4, C-3
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias Contamination	No target compounds >QL
LCS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 20%
MS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	10 (total only; both freshwater and saltwater matrices)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals (total and dissolved): ICP/MS
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	C-5, C-3, C-6
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Accuracy/Bias Contamination	No target compounds >QL
LCS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	Compound-specific %Rs; see Appendix C-2	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	Compound-specific %Rs; see Appendix C-2

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed.	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	10 (total only; both freshwater and saltwater matrices)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals: Mercury (total and dissolved), Low Level
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	B-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	3/Batch (20 samples)	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples
Equipment Rinsate Blank	1 per event per sampling team	No target compound>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/batch	80 -120%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	80 -120%R
CRM	1/Batch (10 samples)	Within 25% of certified value	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Within 25% of certified value
Laboratory Duplicate	1/Batch (10 samples)	RPD ≤24%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤24%
MS	1/Batch (10 samples)	71-125% R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	71-125% R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MSD	1/Batch (10 samples)	≤24% RPD	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	≤24% RPD
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5 (total only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Metals: Methyl Mercury (total and dissolved)
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	B-2
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	Minimum of four MBs with each batch (10 samples)	Average MB ≤0.045 ng/L and standard deviation ≤0.015 ng/L or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	Average MB ≤0.45 ng/L and standard deviation <0.15 ng/L or <0.1x the concentration of project samples
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
CRM	1/Batch (10 samples)	Within 35% of certified value	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Within 35% of certified value
Laboratory Duplicate	1/Batch (10 samples)	RPD ≤ 35% (or ±QL if results are ≤5x the QL)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 35% (or ± QL if result is ≤5x the QL)
MS	1/Batch (10 samples)	65-135%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	65-135%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MSD	1/Batch (10 samples)	≤35% RPD	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	<24% RPD
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5 (total only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Hexavalent Chromium
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04, LPR-FI-06
Analytical Method/ SOP Reference[c]	C-15
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Rochester)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Data Validator	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	90-110%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	90-110%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	90-110%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	90-110%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MSD	1/Batch (20 samples)	RPD ≤20%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5 (total only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Butyltins
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-8, C-7
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compounds >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compounds >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compounds >QL	Evaluate during data validation. Qualify data as needed	Data Validator	Accuracy/Bias Contamination	No target compounds >QL
Surrogate	Every sample	Tripropyltin: 24-142%R	Check calculations and instrument performance; recalculate, reanalyze	Analyst/Section Supervisor	Accuracy/Bias	Tripropyltin: 24-142%R
LCS	1/Batch (20 samples)	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MS	1/Batch (20 samples)	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	Monobutyltin: 40-165%R Dibutyltin: 18-128%R Tributyltin: 30-120%R Tetrabutyltin: 24-104%R
MSD	1/Batch (20 samples)	RPD ≤30%	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Precision	RPD ≤30%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	5	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry - Sulfide
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-14
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS(Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Data Validator	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	74-122%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	74-122%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	74-122%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	74-122%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	SSC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-17
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Xenco (Phoenix)
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – Ammonia -N
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-9
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	90-112%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	90-112%R
Laboratory Duplicate	1/Batch (20 samples)	RPD $\leq$ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD $\leq$ 20%
MS	1/Batch (20 samples)	90-112%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	90-112%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry - Cyanide
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[b]	C-10
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	83-116%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	83-116%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	35-144%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	35-144%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤20% if both samples are >5x QL or absolute difference between concentrations <QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry - TKN
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-12
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	78-117%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	78-117%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	37-158%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	37-158%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] General Chemistry – Total Phosphorus
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] C-11
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization CAS(Kelso)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	88 - 113%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	88 - 113%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	50 -144%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	50 -144%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – TOC and DOC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-13, C-16
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS-Kelso
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	<No target compound>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	<QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	95-105%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	95-105%R
LCSD	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Inorganic Carbon Spike	1/Batch (20 samples)	≤110% of the unspiked sample	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	≤110% of the unspiked sample
MS	1/Batch (20 samples)	80-120%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	80-120%R
MSD	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry - POC
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-16
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Tucson)
Number of Sample Locations	Refer to Worksheet #18

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (10 samples)	<0.025 mg/L or <10% of the concentration in the associated samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	<0.025 mg/L or <10% of the concentration in the associated samples
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1 per 10 samples	95-105%R or within the manufacturer's control limits if >95-105%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	95-105%R or within the manufacturer's control limits if >95-105%R
LFB	1 per 10 samples	85-115%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	85-115%R
Laboratory Duplicate	1 per 10 samples	RPD ≤20% if both samples >10x QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% if both samples >10x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – Alkalinity
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-20
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	94-106%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	94-106%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	General Chemistry – Chlorophyll a
Concentration Level[b]	Low
Sampling SOP	LPR-FI-04
Analytical Method/ SOP Reference[c]	C-22
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Filtration Blank	1 prior to the start of sample filtration and 1 at the conclusion of sample filtration	No target compound >QL	Eliminate source of contamination. Refilter and reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	91-108%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	91-108%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
		between concentrations <2x QL if sample and/or field duplicate are ≤5x QL				between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	1	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] Sulfate and Chloride
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] C-21
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization CAS (Kelso)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	90-110%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	90-110%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	80-120%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	80-120%R

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix Water
Analytical Group[a] General Chemistry – TDS
Concentration Level Low
Sampling SOP[b] LPR-FI-04
Analytical Method/ SOP Reference[c] C-19
Sampler's Name AECOM Field Staff
Field Sampling Organization AECOM
Analytical Organization CAS (Kelso)
Number of Sample Locations All locations

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound >QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Evaluate during data validation. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	85-115%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	85-115%R
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤10%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤10%
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
PE Sample[d]	0 (review only)	Supplier Certified Limits	Feedback to laboratory; laboratory evaluation and response	AECOM Project Chemist/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Bacteria – Fecal streptococci and fecal enterococci
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	E-3, E-4
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	EMSL, Inc.
Number of Sample Locations	5 (Minimum, see Worksheet #20)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1 per batch of 20 samples	No pink-red colored colonies	Reanalyze associated samples, dependent upon extent of holding time exceedance	Analyst/Section Supervisor	Accuracy/Bias Contamination	No pink-red colored colonies
Control Sample	1 per batch of 20 samples	Pink-red colored colonies	Reanalyze associated sample, dependent upon extent of holding time exceedance	Analyst/ Section Supervisor	Accuracy/Bias	Pink-red colored colonies
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Bacteria –Total coliform and *E. coli*
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	E-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	EMSL, Inc.
Number of Sample Locations	5 (Minimum, see Worksheet #20)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1 per batch of 20 samples	No color, no fluorescence	Reanalyze associated samples, dependent upon extent of holding time exceedance	Analyst/Section Supervisor	Accuracy/Bias Contamination	No color, no fluorescence
Control Sample	1 per batch of 20 samples	Yellow color (coliform) with fluorescence (*E.coli*)	Reanalyze associated sample, dependent upon extent of holding time exceedance	Analyst/ Section Supervisor	Accuracy/Bias	Yellow color (coliform) with fluorescence (*E.coli*)
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Bacteria – Fecal coliform
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	E-2
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	EMSL, Inc.
Number of Sample Locations	5 (Minimum, see Worksheet #20)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1 per batch of 20 samples	No blue colored colonies	Reanalyze associated samples, dependent upon extent of holding time exceedance	Analyst/Section Supervisor	Accuracy/Bias Contamination	No blue colored colonies
Control Sample	1 per batch of 20 samples	Blue colored colonies	Reanalyze associated sample, dependent upon extent of holding time exceedance	Analyst/Section Supervisor	Accuracy/Bias	Blue colored colonies
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Refer to Worksheet #31 for additional details of the PE program.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group[a]	Protozoans - Cryptosporidium and *Giardia*
Concentration Level	Low
Sampling SOP[b]	LPR-FI-04
Analytical Method/ SOP Reference[c]	S-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	ASI
Number of Sample Locations	5 (Minimum, see Worksheet #20)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1 per batch of 20 samples	No detected oocysts or cysts	Reanalyze associated samples, dependent upon extent of holding time exceedance	Analyst/Section Supervisor	Accuracy/Bias Contamination	No detected oocysts or cysts
Control Sample	1 per batch of 20 samples	*Giardia* (14-100%R) Cryptosporidium (11-100%R)	Reanalyze associated sample, dependent upon extent of holding time exceedance	Analyst/ Section Supervisor	Accuracy/Bias	See SOP control limits
Field Duplicate	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL
MS	1/10 field samples	*Giardia* (14-118%R) Cryptosporidium (13-111%R)	Evaluate during data validation. Qualify data as needed	Data Validator	Accuracy/Bias	See SOP control limits

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field notes, field data sheets, field logbooks	Field notes, field data sheets, field logbooks	Custody records and copies of airbills	Field TSA reports	Progress reports
Custody records and airbills	Field instrument calibration records	Analytical data packages and EDDs	AECOM assessment of external laboratory audit findings	Final report - Prepared and submitted to clients and USEPA.
Communication logs, records or copies of pertinent e-mails	Field measurement data	Communication logs	DVRs	
QAPP/FSP Addendum and HASP	QAPP/FSP Addendum and HASP	Laboratory notebooks and bench sheets documenting sample preparation and analysis	QA reports to management	
Corrective action (CA) reports and results	CA reports and results	Instrument maintenance and calibration records, standard preparation and traceability records	CA reports and results	
Documentation of field modifications	Documentation of field modifications	Laboratory SOPs and documentation of method modifications	Internal laboratory assessments, including internal audits, third-party audit reports, and PE results	
Daily Activity Log	Daily Activity Log	CA logs and documentation of CA results	AECOM assessment PE sample results	

This section describes the project data management process tracing the data from their generation through final use and/or storage. All project data, communications, and other information must be documented in a format useable to project personnel.

Project Document Control System

Project documents are controlled by AECOM's Project Document Control Manager who will maintain and manage hardcopies and electronic copies of all project related documents according to the Lower Passaic River QMP (AECOM 2009). Electronic copies of all information relating to this project are maintained on the project network files, which are backed up at least once per day; access to these files is limited to authorized project personnel. All project data and information must be documented in a standard format that is usable by all project personnel.

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

Data Recording

Data generated during this project will be captured electronically or entered by hand into bound field or laboratory logbooks or preprinted forms (refer to SOP LPR-G-01 in Appendix B). Computer generated laboratory data will be managed using the laboratory information management system (LIMS); the LIMS used by subcontracted laboratories are described in their QA documentation.

Data Quality Assurance Procedures

AECOM will monitor the progress of sample collection to verify that samples are collected as planned. The progress of sample collection and processing will be monitored through the documentation of samples collected and shipped each day. The participating laboratories must maintain a formal QMP to which they adhere and which addresses all data generating aspects of daily operations. A policy of continuous improvement will allow all data generation processes to be reviewed and modified as needed to meet project objectives. Periodic audits of field and laboratory operations will ensure that data collection, documentation and QC procedures are being followed.

Laboratory Data Transmittal

Laboratory data are managed by the laboratory's LIMS beginning with the sample receiving process. Laboratories are required to provide validated data reports (sample results, QC summary information, and supporting raw data) including EDDs within the turnaround times specified in Worksheet #30. EDDs will be provided in an Earthsoft EQuIS® four-file format (modified by AECOM), using reference file tables provided by AECOM. All EDDs will be checked prior to transmittal to AECOM using current versions of Earthsoft's Electronic Data Processor (EDP).

Data Storage and Retrieval

Completed forms, logbooks, photographs, data packages, and electronic files will be transmitted regularly to the AECOM Project Document Control Manager. Each laboratory will maintain copies of all documents it generates as well as backup files of all electronic data relating to the analysis of samples. Raw data and electronic files of all field samples, QC analyses and blanks must be archived from the date of generation and maintained by each laboratory in accordance with the terms of the contract between AECOM and the laboratory. Project closeout will be conducted in accordance with contractual guidance. As required by the Settlement Agreement all data and other project records will be made available to USEPA.

Data transfer to USEPA will include a Multimedia Electronic Data Deliverable (MEDD) that conforms to USEPA Region 2 MEDD format ([HYPERLINK "http://www.epa.gov/region02/superfund/medd.htm"]). The MEDD will include all qualified and rejected data (including the reported, numerical value for rejected data per the request of USEPA). Laboratory data packages and DVRs will also be transmitted to USEPA monthly.

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization)[b]
Water	VOCs	Low	All	C-1	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Water	SVOCs	Low	All	T-2	30 days	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222
Water	PAHs –LRMS SIM	Low	All	T-4	45 days	TestAmerica 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222
Water	OC Pesticides	Low	All	T-11	45 days	TestAmerica 880 Riverside Parkway West Sacramento, CA 95605 David Alltucker 916.374.4334	Vista Analytical Laboratory 1104 WIndfield Way El Dorado Hills, CA 95762 Martha Maier 916.673.1520
Water	PCBs (Homologs and Congeners)	Low	All	T-6	45 days	TestAmerica 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Todd Vilen 910-794-1613
Water	PCDD/PCDFs	Low	All	A-1	45 days	Analytical Perspectives 2714 Exchange Drive Wilmington, NC 28405 Todd Vilen 910-794-1613	TestAmerica 880 Riverside Parkway West Sacramento, CA 95605 David Alltucker 916.374.4334

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization)[b]
Water	TAL Metals (excluding mercury) and Titanium (total and dissolved), hardness (by calculation)	Low	All	C-4, C-5	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206
Water	Low Level Mercury (total and dissolved)	Low	All	B-1	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222
Water	Methyl Mercury (total and dissolved)	Low	All	B-2	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222
Water	Hexavalent Chromium	Low	All	C-15	30 Days	CAS 1 Mustard St. Suite 250 Rochester, NY 14609 Janice Jaeger 585.288.5380	NA
Water	Butyltins	Low	All	C-8	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization)[b]
Water	Sulfate and Chloride	Low	All	C-21	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	Ammonia-N	Low	All	C-9	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	Cyanide	Low	All	C-10	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	TKN	Low	All	C-12	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 4101 Shuffel Dr. NW North Canton, OH 44720 Ken Kuzior 330.497.9396
Water	Total Phosphorus	Low	All	C-11	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 4101 Shuffel Dr. NW North Canton, OH 44720 Ken Kuzior 330.497.9396
Water	TOC/DOC	Low	All	C-13	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	TestAmerica 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization)[b]
Water	POC	Low	All	C-16	30 days	CAS 3860 S. Palo Verde Road, Suite 302 Tucson, AZ 85714 Todd Poyfair 602.443.7019	TestAmerica 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	Total Sulfide	Low	All	C-14	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	TDS	Low	All	C-19	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	Alkalinity	Low	All	C-20	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	SSC	Low	All	C-17	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	Test America 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000
Water	Chlorophyll a	Low	All	C-22	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Ed Wallace 360.577.7222	NA

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization)[b]
Water	Bacteria	Low	See Worksheet #18	E-1, E-2, E-3, E-4	30 days	EMSL, Inc. 200 Route 130 N. Cinnaminson, NJ 08077 Jason Dobranic 800-220-3675	NA
Water	Protozoans	Low	See Worksheet #18	S-1	30 days	Analytical Services, Inc. 130 Allen Brook Lane Williston, VT 05495 Paul S. Warden 800.723.4432 x15	NA

[a] Turnaround time is in calendar days from receipt of the last sample in the data package sample delivery group per sampling event.

[b] The backup laboratory will only be used if the primary laboratory is unable to analyze the samples or if serious QC issues with the primary laboratory occur. Prior to use of a backup laboratory, the laboratory's SOPs, detection limits, and PE data will be assessed to minimize inter-laboratory variability. Any change in laboratories will be communicated to USEPA prior to the change.

QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Safety Audit	Once, during the first week of field work; follow-up audits as necessary	Internal	AECOM	AECOM Regional EHS Manager	AECOM FTM, SSO, and CWCM Task Manager	AECOM FTM, SSO and CWCM Task Manager	AECOM Regional EHS Manager
Field TSA	Once during the first week of field work; follow-up audits as necessary	Internal	AECOM	AECOM Project QA Manager or designee	AECOM FTM and CWCM Task Manager	AECOM FTM and CWCM Task Manager	AECOM Project QA Manager
Laboratory Audits	Per laboratory QMP; at least annually	Internal	Laboratory	Laboratory QA Officer or designee	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer
	Per certification requirements	External	State or national certifying authority	State or national certifying authority auditor	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer
Review of External Laboratory Audit Findings	Prior to start of CWCM and periodically as needed	External	AECOM	AECOM Project Chemist, under direction of AECOM QA Manager	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer AECOM Project Chemist and AECOM Project QA Manager
Non-conformance Reporting	As needed	Internal	AECOM	AECOM Project QA Manager or designee	AECOM FTM and CWCM Task Manager	AECOM FTM and CWCM Task Manager	AECOM Project QA Manager
PE samples	Prior to field work; with first event and up to quarterly as necessary	External	AECOM	AECOM Project Chemist , under direction of AECOM QA Manager	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer AECOM Project Chemist And AECOM Project QA Manager

QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) Planned Project Assessments Table

Assessments

Assessment activities will measure the effectiveness of the project implementation and associated QA/QC activities. Audits are used as a means of monitoring the performance of field and laboratory activities and are conducted by the Regional EHS Manager (safety audits), Project QA Manager (TSAs), or a qualified alternate. Audits will include systems audits that are more qualitative in nature and will be made at appropriate intervals to ensure that all aspects of the QA program are operative. Performance audits are quantitative audits that are conducted to assess the accuracy of measurement systems; this would include the use of PE samples.

Safety audits and TSAs will be conducted for field operations to assess implementation of project requirements and determine if the systems under review are capable of meeting project PQOs. These audits will include observations of procedures, discussions with project personnel, and review of records. Any minor deficiencies noted during an audit will be corrected immediately. If a major deficiency is noted during an audit, a stop work order will be issued until the deficiency can be corrected and the effectiveness of the CA measured and documented. A stop work order may be issued by the Regional EHS Manager or Project QA Manager, as appropriate, who will notify the CWCM Task Manager and the AECOM PM. The conditions that lead to a stop work order must be documented in sufficient detail to clearly define the problem and identify possible corrective measures. All communications among project staff that address evaluation of the problem and appropriate solutions must be attached to the stop work order. The Project QA Manager or Regional EHS Manager, the CWCM Task Manager, and AECOM PM must agree in writing to resume work after review of the data supporting correction of the deficiency. The Project QA Manager and Regional EHS Manager will maintain documentation of the deficiencies that were noted, the individual(s) responsible for follow-up, documentation of the effectiveness of the CAs taken, and implementation of procedures to prevent recurrence of the problem.

No project-specific on-site system audits of laboratories are planned for the CWCM. However, participating laboratories are required to take part in regularly scheduled audits required by state and federal agencies as part of ongoing certification or participation in specific contracts. For those audits conducted within 6 months of the start of, or during the course of, the CWCM program, the laboratories must provide copies of the results of these third-party audits to the Project Chemist. Any change in laboratory ownership, management, or certification status must also be immediately reported to the Project Chemist. The Project Chemist, under the direction of the Project QA Manager, will review the third-party audit reports. Any significant deficiencies will require follow up and resolution with the laboratory. The Project Chemist will prepare a written summary of findings and CAs.

The PE program for the CWCM will involve two parts: (1) an evaluation of recent PE data provided by the laboratories and performed as part of their routine participation in USEPA Water Supply (WS) and Water Pollution (WP) certification programs, and (2) analysis of new PE samples purchased by AECOM from a commercial vendor (for example, Resource Technology Corporation). A complete set of blind PE samples for all analyte groups (except for General Chemistry) will be analyzed by both the primary and back-up laboratories before the field sampling begins. An evaluation will be performed by the Project Chemist, who will prepare a written report summarizing the results, actions taken, and resolution of any issues based on the pre-program PE result datasets. In addition to the pre-program PEs, the participating laboratories will analyze known PE samples or certified

QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) Planned Project Assessments Table

reference materials (CRMs), which are not blind, at the start of each field sampling event, not to exceed once per calendar quarter. Given the frequency of the events (8 per year) and that some may occur within a few weeks of each other, PE/CRM samples prior to every sampling event is not warranted. To meet the Quality Control Check Sample (QCCS) analysis requirement for PCDD/Fs, PCBs, and OCPs per Methods 1613B, 1668A, and 1699, a minimum of one PE or CRM sample will be analyzed with field samples per sampling event. If possible, the same QC sample lot used as a blind PE in the pre-program analyses will also be used as the known PE/CRM/QCCS material for the PE samples analyzed during the field program to provide a consistent baseline monitoring of laboratory performance over time. Results for all PE, CRM, and QCCS samples will be reviewed by the Project Chemist. The Project Chemist or data validators will prepare a written summary of findings and CAs.

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Safety Audit	Written audit report	AECOM PM, CWCM Task Manager, AECOM FTM/SSO	Verbal summary of major findings within 24 hours; written report within one week.	Memo with possible reaudit	AECOM Regional EHS Manager, AECOM PM, CWCM Task Manager	One week
Field TSA	Written audit report	AECOM PM, CWCM Task Manager, AECOM FTM, CPG QA Coordinator	Verbal summary of major findings within 24 hours; written report within one week.	Memo with possible reaudit	Project QA Manager, AECOM PM, CWCM Task Manager, CPG QA Coordinator, USEPA RPM	One week
Internal Laboratory Audits	Written audit report	Laboratory Manager	As required by laboratory QMP	Memo or as required by laboratory QMP	Laboratory Manager, Laboratory PM AECOM Project Chemist and Project QA Manager (if project PQOs are affected)	As required by laboratory QMP
External Laboratory Audits	Written audit report	Laboratory Manager	Major deficiencies communicated orally at exit meeting; written report based on policy of external auditing organization	Letter or as required by external auditing organization with possible reaudit	External auditing organization	As required by external auditing organization.
Review of External Laboratory Audit Findings	Written report	AECOM PM, AECOM CWCM Task Manager, AECOM QA Manager, CPG QA Coordinator	30 days from receipt of report	Written response	AECOM Project Chemist and AECOM Project QA Manager	30 days

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Non-conformance Reporting	Written report	AECOM PM, AECOM CWCM Task Manager, AECOM QA Manager, CPG QA Coordinator	Verbal summary of major findings within 24 hours; written report within one week.	Memo with possible corrective action	Project QA Manager, AECOM PM, CWCM Task Manager, CPG QA Coordinator	One week
PE samples	Written PE results evaluation report	Laboratory Manager	Deficiencies (results outside acceptance range) identified within one week of receiving laboratory results	Letter with request for laboratory investigation into deficiencies and CA, if necessary, before project field samples are analyzed. CA may include investigation and preparation by the laboratory of a CA report, analysis of a new PE sample, or if AECOM deems appropriate, the analyses may be moved to another lab.	AECOM Project Chemist, Project QA Manager, and CPG QA Coordinator	One week

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Corrective Action Responses

Non-Conformance/QC Reporting

A non-conformance is defined as an identified or suspected deficiency in, or deviation from, procedures described in an approved document (e.g., improper sampling procedures, improper instrument calibration, errors in calculations or errors in computer algorithms); an item where the quality of the end product itself or subsequent activities conducted using the document or item would be affected by the deficiency; or an activity that is not conducted in accordance with established plans or procedures. Any project staff member that discovers or suspects a non-conformance is responsible for initiating a non-conformance report to the Project QA Manager. The Project QA Manager will evaluate each non-conformance report and provide a response describing the actions to be taken and assigning responsibility for the CA. The appropriate Task Manager will verify that the nonconforming item or procedure is not used until the CA has been performed and found to produce acceptable results. If the non-conformance involves instrumentation or equipment, the device must be tagged to indicate it is defective and not to be used.

A copy of each non-conformance report will be added to the project file. Original non-conformance reports will be maintained by the Project QA Manager or designate.

QAPP Worksheet #33 (UFP-QAPP Manual Section 4.2) QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Progress Reports	Monthly	Due the 15th of each month	AECOM PM/ CPG Project Coordinator	USEPA RPM
Field TSA Reports	Per Worksheet #31	Within one month after field work begins and at least annually or as required during program	AECOM Project QA Manager/auditor	CWCM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM
Review of External Laboratory Audit Reports	As required	Within 30 days of submittal by laboratory	AECOM Project QA Manager/Project Chemist	CWCM Task Manager, AECOM PM, CPG QA Coordinator
DVRs	After laboratory data are received and validated	See Worksheet #16	AECOM Validation Coordinator	AECOM Project QA Manager, CWCM Task Manager, and AECOM PM, USEPA RPM
Nonconformance report	As needed	When a nonconformance is identified; submitted as part of monthly progress report	AECOM staff	AECOM Project QA Manager, CWCM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM
CA Reports	When CA is required	Within 30 days of resolution of CA	AECOM Project QA Manager or designated Task Manager	AECOM PM, CWCM Task Manager, Project Team Members, CPG QA Coordinator, CPG Project Coordinator, USEPA RPM

The monthly progress report will address the results of any CAs or audits that took place during the reporting period as well as any trends noted during the data validation process. Problems or issues that arise between regular reporting periods may be identified to management at any time. Information included in the monthly progress report will include:

- Results of audits conducted during the reporting period;
- Discussion of problems with measurement data including issues related to precision, accuracy, completeness, representativeness, and comparability that could affect achievement of the PQOs; and
- A listing of any nonconformance reports or stop-work orders, the associated CAs taken, and the outcome of these CAs.

QAPP Worksheet #34 (UFP-QAPP Manual Section 5.2.1) Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification
Field data	Field data, including equipment decontamination records, sample equipment calibration logs, and field measurements, will be reviewed for completeness, accuracy and agreement with SOP LPR-G-01 (Field Records).	Internal	CWCM Task Manager or designee
Chain-of-Custody	The COC will be reviewed initially in the field for complete and correct information.	Internal	AECOM FTM, CWCM Task Manager, or designee
	Upon receipt at the lab, the COC will be compared to sample containers and any discrepancies will be resolved.	External	Laboratory Sample Custodian
	During validation the COC will be verified against laboratory receipt and reporting information.	External	Data Validator
Sample Condition	Holding temperature, holding time and preservation will be reviewed when accepting custody of samples and coolers.	External	Laboratory Sample Custodian
Laboratory Data Packages and EDDs	Laboratory data (hard copy and EDDs) will be verified by the laboratory performing the work for completeness and technical accuracy prior to release.	External	Laboratory
	Laboratory data will be assessed using the validation procedures described in Worksheets #35 and #36.	Internal	Data Validator
Audit Reports	Field system audit reports will be reviewed to confirm that specified CAs have been taken, the CA has been effective and all documentation of CA is attached to the audit report.	Internal	AECOM Project QA Manager or designee
	Internal laboratory audits will be reviewed to confirm that specified CAs have been taken, the CA has been effective and all documentation of CA is complete.	External	Laboratory QA Manager
Assessment actions and reports	QA/QC process will be reviewed for agreement with QAPP/FSP Addendum.	External	ddms, inc., CPG Project QA Coordinator, or designee

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Debra Simmons, Project QA Manager/AECOM
IIa	Analytical data deliverables, contractual documents	Verify the required deliverables, analyte lists, method holding times, analytical procedures, laboratory qualifiers, measurement criteria, project quantitation limits, and analyses of PE samples conform to specifications. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Laboratory EDDs, analytical data reports, database output	Verify EDDs against hard-copy analytical reports.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports	Verify that reported analytes, holding times, analytical procedures, measurement criteria, and project quantitation limits conform to the QAPP. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports, validation guidance	Combination full/limited data validation (see details below)	Lisa Krowitz, Validation Coordinator/AECOM
IIb	QAPP, analytical data reports, validation guidance	Verify that the qualifiers applied during validation were in conformance with the QAPP and specified validation guidance.	Lisa Krowitz, Validation Coordinator/AECOM

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIb	Analytical data reports	Verify that all project required PE samples were analyzed and that results met the acceptance criteria.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Debra Simmons, Project QA Manager/AECOM

Data Validation

At a minimum, 100% full validation (includes review of raw data and spot check for verification of calculations) will be conducted for PCDD/PCDFs, PCB Homologs and Congeners, mercury and methyl mercury for each sample delivery group (SDG). For all other parameters, 100% full validation (as appropriate to the analyses) will be performed on the first SDG. The remaining SDGs will be subject to full validation for every five SDGs, and limited validation for the remaining SDGs.

Limited validation will be based on information provided by the laboratory on their QC forms, and will include no or minimal raw data review. At a minimum, limited validation will include the following data elements:

- Agreement of analyses conducted with COC requests
- Holding times and sample preservation
- Initial and continuing calibrations and analytical sequence
- Mass spectrometer tuning (GC/MS only)
- Internal standard performance (GC/MS only)
- Laboratory blanks/equipment rinsate blanks/ trip blanks
- Surrogate recoveries
- LCS (or equivalent) results
- MS/MSD results
- Laboratory duplicate results

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

- Field duplicate results
- ICS results (AB solution only)
- ICP serial dilution results
- Quantitation limits and sample results (limited to evaluating dilutions and reanalyses)

If significant issues (e.g., those affecting achievement of the PQOs) are noted during full validation, the limited validation may be expanded to include this issue. Systematic or random errors that would not be detected during a review of the summary forms might include, for example, misidentification or quantitation of compounds, transcription errors, or calculation errors. In addition, limited validation will provide review of key laboratory QC elements, which would highlight potential underlying lab issues that may require further investigation (i.e., full validation effort). If a high frequency of measurement performance issues is found, the issue will be investigated and an additional validation effort may be implemented. AECOM plans to maintain communication/notification systems with the laboratory during the analytical process to circumvent significant QC issues. If QC issues do arise, investigations and CAs will be documented and implemented in a timely fashion to optimize the amount of un-qualified data.

In addition, data packages receiving limited validation will receive a completeness check so that full validation could be performed at a later date, if necessary. The check will verify that the raw data for each sample (including all reanalyses and dilutions) are present and complete. The data supporting the sample results, such as QC samples (method blanks, LCS, MS/MSD), calibrations, tunes, and preparation logs, will also be reviewed for overall completeness, however, an in-depth inventory to ensure specific association with all sample data will not be performed.

No additional completeness check will be performed for the bacterial or protozoan tests due to limited back-up information provided and the nature of the tests.

The qualifiers applied during validation will be consistent with those in the validation guidance and are summarized in the table below. Qualifiers will be applied based on the criteria in the QAPP, method-specific Region 2 validation guidance, or professional judgment. Method-specific validation SOPs will be prepared to explain the rules for qualifier application and to minimize differences due to professional judgment. DVRs summarizing data qualification as a result of the validation effort will be prepared and submitted as described in Worksheet #16.

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Process Table

Validation Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample. "J" flags will be assigned by the validator based on nonconformance with the validation criteria (for example, holding times, surrogate recoveries) noted in Worksheet #36. In addition, "J" flags applied by the laboratory due to results being between the QL and MDL or EDL will be retained during validation.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".
JN	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
UJ	The analyte was not detected above the reported sample QL. However, the reported QL is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above, the reported sample QL.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria*	Data Validator (title and organizational affiliation)
IIa	Water	Metals (total and dissolved)	Low	Region 2 validation SOP HW-2, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	Butyltins	Low	Region 2 validation SOP HW-44, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	PCDD/PCDFs	Low	Region 2 validation SOP HW-25	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	Low Level Mercury (total and dissolved)	Low	Region 2 validation SOP HW-2, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	Methyl Mercury (total and dissolved)	Low	Region 2 validation SOP HW-2, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	Hexavalent Chromium	Low	NJDEP SOP 5.A.10, rev. no. 2, modified	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	OC Pesticides	Low	Region 2 validation SOP HW-25, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	PCBs – Homologs and Congeners	Low	Region 2 validation SOP HW-46	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	SVOCs	Low	Region 2 validation SOP HW-22	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	PAHs and Alkyl PAHs – LRMS-SIM	Low	Region 2 validation SOP HW-22, modified for method	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	VOCs	Low	Region 2 validation SOP HW-24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	General chemistry	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Water	Bacterial	Low	QAPP Worksheets 12, 15, and19	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Metals	Low	Region 2 validation SOP HW-2, modified, and/or QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Butyltins	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria*	Data Validator (title and organizational affiliation)
IIb	Water	PCDD/PCDFs	Low	Region 2 validation SOP HW-25 and/or QAPP Worksheets 12, 15, 19, and 24, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Low Level Mercury	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Methyl Mercury	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Hexavalent Chromium	Low	NJDEP SOP 5.A.10, rev. no. 2, modified, and/or QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	OC Pesticides	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	PCBs – Homologs and Congeners	Low	Region 2 validation SOP HW-46 and/or QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	SVOCs	Low	Region 2 validation SOP HW-22 and/or QAPP Worksheets 12, 15, 19, and 24, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	PAHs and Alkyl PAHs – LRMS-SIM	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	VOCs	Low	Region 2 validation SOP HW-24 and/or QAPP Worksheets 12, 15, 19, and 24, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	General chemistry	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	**Matrix**	**Analytical Group**	**Concentration Level**	**Validation Criteria***	**Data Validator (title and organizational affiliation)**
IIb	Water	Bacterial	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Water	Protozoans	Low	QAPP Worksheets 12, 15, 19, and 24	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

*Validation criteria include professional judgment where appropriate and necessary. The most current versions of the Region 2 data validation SOPs will be used. Note that modifications to the Region 2 data validation SOPs are performed when there is no SOP for the specified method. In those cases, the most relevant Region 2 data validation SOP is used as a reference, and modified for method- specific criteria, with the validation actions being consistent with Region 2 guidance where possible. Modifications to the Region 2 SOPs may also be made to incorporate the performance measurement criteria for this project. Modifications will be discussed in the DVRs.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
AECOM's data validation staff will validate all laboratory data in accordance with the protocols described in Worksheet #36. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site. The results of laboratory measurements will be compared to the PQOs described in Worksheet #11 of this document.

Describe the evaluative procedures used to assess overall measurement error associated with the project:
During the data validation process the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies that become apparent during the validation process or as the users evaluate the data will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet #28, or quality levels of Worksheet #15, or analytical performance criteria specified in Worksheet #12 will be clearly identified in the database so data users are aware of any limitations associated with data usability. Data that were flagged with an "R" (rejected) during data validation are not considered usable and will not be used to make decisions related to further actions at the site. Details of the problems identified during data validation and the bias in the data will be provided in the associated DVR.

Identify the personnel responsible for performing the usability assessment:
Data validation will be performed by data validation staff under the supervision of the Project QA Manager. The usability assessment will be performed jointly by the AECOM and CPG project teams and will include input by field personnel, QA staff, project chemists, and project management. The CWCM Task Manager will be responsible for the data usability assessment.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:
The documentation generated during data validation will include a DVR that describes the information reviewed, the results of this review and provides a recommendation on overall data usability and limitations on specific data points. The DVR and associated validation documentation will provide information on the samples included in the review and the date they were collected; the condition of samples when received at the laboratory and any discrepancies noted during the receiving process; verification of sample preparation and analysis within the method specified holding time; instrument calibration information; review of associated QC analyses including blanks, LCSs, matrix spikes, and field and/or laboratory duplicates; and verification of selected reported values from raw data. As a result of this review, standard qualifiers will be entered into the database so that data users can readily identify any limitations associated with a specific data point.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Usability Assessment

Assessment of data usability will be performed by data validation staff using current USEPA Region 2 data validation guidance. The results of the Data Usability Assessment will be summarized in the final Technical Memorandum. The following items will be assessed and conclusions drawn based on their results:

Holding Time: All sample data will be checked to verify that both sample preparation and analysis were performed within the method required holding time.

Calibration: Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.

Accuracy/Bias Contamination: Results for all equipment rinsate blanks, trip blanks, laboratory method blanks, and instrument calibration blanks will be checked against performance criteria specified in Worksheet #28; results for analytes that exceed criteria will be identified and the impact on field sample data will be assessed. Data will be summarized by type of blank.

Accuracy/Bias Overall: Reported values of LCSs and matrix spikes will be evaluated against the spiked or certified concentration and the percent recovery will be calculated and compared to the criteria specified in Worksheet #28. The percent recovery information will be used to assess the bias associated with the analysis. Recovery for matrix spikes in conjunction with the recovery reported for LCSs will provide information on the impact of the sample matrix on specific analyses. Accuracy will be calculated as follows: where X = the observed value of measurement and T = 'true' value

[EMBED Equation.3]

Precision: Results of the RPD will be calculated for each analyte in laboratory and field duplicates. These RPDs will be checked against measurement performance criteria presented on Worksheet #28; RPDs exceeding the stated criteria will be identified. Any limitations on the use of the data based on precision problems will be reported. The RPD is calculated as follows:

where: RPD = relative percent difference; D_1 = first sample value; and D_2 = second sample value (duplicate)

[EMBED Equation.3]

Sensitivity: Reporting limits will be checked against the Project Action Levels presented on Worksheet #15 and QLs presented on Worksheet #15. Limitations on the use of the data and conclusions about the sensitivity of the analysis will be reported.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Usability Assessment

Representativeness: A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly, laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures that might impact the representativeness of the sample will be discussed in the Technical Memorandum.

Comparability: The sampling and analytical procedures that will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or which will be conducted in the future. Any modifications or deviations from stated procedures that might impact data comparability will be addressed in the Technical Memorandum.

Completeness: Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis. Completeness will be reported for each analytical category and an overall value will be reported. As shown in Worksheet #12, the analytical completeness goal is ≥90%. Completeness for the field program will be calculated as the number of samples successfully collected compared to the total number proposed in this QAPP/FSP Addendum. The completeness goal for the field sampling program is ≥95%. Percent completeness will be calculated as follows: where X = the number of usable data points and T = total data points

[EMBED Equation.3]

The Project QLs presented on Worksheet #15 will be reviewed to determine if the stated objective was met. The major impacts observed from data validation, DQI and measurement performance criteria assessments will be used to assess the overall data quality and whether Project QLs were achieved. The final Technical Memorandum will summarize the information used to reconcile each objective and overall conclusions regarding data quality.

Attachment 1

References

AECOM in prep. Low Resolution Coring Characterization Summary. Lower Passaic River Study Area RI/FS. Draft submitted February 2010.

AECOM 2010a. Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project. Revision 4. March 2010.

AECOM 2010b. Lower Passaic River Restoration Project Data Management Plan. AECOM, Westford, MA. July 2010, including all revisions.

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. AECOM, Westford, MA, September 2009 or current version.

AECOM 2008. Lower Passaic River Restoration Project. Periodic Bathymetric Surveys. Quality Assurance Project Plan. AECOM, Westford, MA. October 2008.

APHA 1998. Standard Methods for the examination of Water and Wastewater, 20th Edition, American Public Health Association, 1998

ASTM 2010 Annual Book of ASTM Standards, Water, and Environmental Technology, Section 11, Volumes 11.01 and 11.02,

Battelle 2005. Lower Passaic River Restoration Project. Pathways Analysis Report. Prepared for U.S. Environmental Protection Agency Region 2 and U.S. Army Corps of Engineers. Battelle, Duxbury, Massachusetts.

CARB 1997 Method 429: Determination of Polycyclic Aromatic Hydrocarbon Emissions from Stationary Sources, Air Resources Board, California Environmental Protection Agency

CLH 1995. Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans. Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.

ENSR 2008. Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling. Revision 4. ENSR, Westford, MA. October 2008.

Iannuzzi, T.J. and D.F. Ludwig. 2004. Historical and current ecology of the Lower Passaic River. Urb Habit 2(1):3–30.

Iannuzzi, T.J., D.F. Ludwig, J.C. Kinnell, J.M. Wallin, W.H. Desvousges, and R.W. Dunford. 2002. A common tragedy: history of an urban river. Amherst Scientific Publishers, Amherst, MA.

Krone, C.A.; Brown, D.W.; Burrows, D.G.; Bogar, R.G.; Chan, S.; Varanasi, U.A. 1988 *Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound,* Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1988.

Malcolm Pirnie, Inc. (MPI) 2004-2005. LPRSA RI/FS Sampling Program. [HYPERLINK "http://www.ourpassaic.org"] (Last accessed January 20, 2008).

Malcolm Pirnie, Inc. (MPI) 2005. Lower Passaic River Restoration Project. Quality Assurance Project Plan. Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY. August 2005.

Malcolm Pirnie, Inc. (MPI) 2006. Lower Passaic River Restoration Project. Draft Field Sampling Plan. Volume 1. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY; Earth Tech, Inc., Bloomfield, NJ; Battelle, Stony Brook, NY. January 2006.

Malcolm Pirnie, Inc. (MPI) 2007a. *Draft Source Control Early Action Focussed Feasilibity Study. for Lower Passaic River Restoration Project.* Malcolm Pirnie, Inc., White Plains, NY. June 2007.

Malcolm Pirnie, Inc. (MPI) 2007b. Lower Passaic River Restoration Project. Conceptual Site Model. Prepared for US Environmental Protection Agency, US Army Corps of Engineers, and New Jersey Department of Transportation/Office of Maritime Resources. Malcolm Pirnie, Inc., White Plains, NY. February 2007.

Malcolm Pirnie, Inc. (MPI) 2007c. *QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation.* Malcolm Pirnie, Inc., White Plains, NY. December 2007.

Malcolm Pirnie, Inc. (MPI), Earth Tech, Battelle. 2006. Lower Passaic River Restoration Project. Draft Field Sampling Plan. Volume 2. Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY; June 2006.

National Oceanic and Atmospheric Administration (NOAA). 1984. A geochemical assessment of sedimentation and contaminant distributions in the Hudson-Raritan Estuary. National Oceanic and Atmospheric Administration, National Ocean Service, Rockville, MD.

NJDEP 2008. Surface Water Quality Standards. N.J.A.C. 7:9B. Available online: http://www.nj.gov/dep/rules/rules/njac7_9b.pdf

NY/NJ HEP 2004. Contamination assessment and reduction project. Data download and GIS mapping information. NY/NJ Harbor Estuary Program. Available online: http://www.carpweb.org/main.html.

Rutgers University. 2004 to 2005. [HYPERLINK "http://www.marine.rutgers.edu/cool/passaic/"] (accessed January 20, 2008).

Sommerfield, C.K. and R. J. Chant. 2010. Mechanisms of Sediment Trapping and Accumulation in Newark Bay, New Jersey: An Engineered Estuarine Basin (HRF 008/07A). Prepared for the Hudson River Foundation, July 2010. Suter, G.W. II, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening of Potential Contaminants of Concern for Effects on Aquatic Biota on Oak Ridge Reservation: 1996 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. 104pp. ES/ER/TM-96/R2.

Suszkowski, D.J. 1978. Sedimentology of Newark Bay, New Jersey: an urban estuarine bay. Doctoral Dissertation, University of Delaware.

Tierra Solutions, Inc. 1999. Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan. March 1999.

Tierra Solutions, Inc. 2004. Newark Bay Study Area Remedial Investigation Work Plan. Sediment Sampling and Source Identification Program. Newark Bay, New Jersey. Volume 1a of 3. Inventory and Overview Report of Historical Data. Text and Appendices. Revision 0. June 2004.

Tierra Solutions, Inc. 2011. Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area.

USEPA 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, Office of Water. March 1979 and Revised March 1983

USEPA 1997. Methods for the Determination of Chemical Substances in Marine and Estuarine Environmental Matrices - 2nd Edition, EPA/600/R-97/072, Office of Research and Development, 1997

USACE 1997. Final environmental impact statement on the Newark Bay Confined Disposal Facility. U.S.Army Corps of Engineers, New York District, New York, NY. April 1997.

USACE 2001. Requirements of Sampling and Analysis Plans. EM-200-1-3. February 2001.

USACE 2007. Lower Passaic River Restoration Project source control early action (Draft). Appendix F, Navigation Studies, CENAN - Lower Passaic River navigation analysis. US Army Corps of Engineers New York District.

USEPA 2005. Intergovernmental Data Quality Task Force Uniform Federal Policy for Quality Assurance Project Plans Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP Manual Publication Numbers: EPA: EPA-505-B-04-900A DOD: DTIC ADA 427785 Final Version 1 March 2005.

USEPA 2007a. Administrative Settlement Agreement and Order on Consent for Remedial Investigation/ Feasibility Study. CERCL Docket No. 02-2007-2009. May 2007.

USEPA 2007b. Contract Laboratory Program Guidance for Field Samplers. OSWER 9240.0-44. EPA 540-R-07-06. FINAL July 2007.

USEPA 2008a ``Final Update IV'' to the Third Edition of the manual, ``Test Methods for Evaluating Solid Waste,Physical/Chemical Methods,'' EPA publication SW-846, Office of Solid Waste, January 3, 2008 Available online : [HYPERLINK "http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm"]

USEPA 2009a. National Recommended Water Quality Criteria. Last updated December 2, 2009. Available online : [HYPERLINK "http://www.epa.gov/waterscience/criteria/wqctable/"]

USEPA 2009b. Drinking Water Contaminants, Maximum Contaminant Levels. Last updated September 11, 2009. Available online: [HYPERLINK "http://www.epa.gov/safewater/contaminants/index.html/"]

USEPA 2009c. Regional Screening Levels (Formerly PRGs). Screening Levels for Chemical Contaminants. Updated December 2009. Available online: [HYPERLINK "http://www.epa.gov/region9/superfund/prg/index.html/"]

USEPA 2010a Approved General-Purpose Methods, Office of Water, Office of Science and Technology. Available online: [HYPERLINK "http://water.epa.gov/scitech/swguidance/methods/methods_index.cfm"]

USEPA 2010b General Methods, Office of Water, Office of Science and Technology. Available online: http://water.epa.gov/scitech/swguidance/methods/other.cfm

USGS. Gage 01389500 – Passaic River at Little Falls, New Jersey. [HYPERLINK "http://waterdata.usgs.gov/nj/nwis/nwisman/?site_no=01389500&agency_cd=USGS"]

Windward 2009a. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and decapod crustacean tissue collection for chemical analysis and fish community survey*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA

Windward 2009b. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface sediment chemical analyses and benthic invertebrate toxicity and bioaccumulation testing*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA.

Windward and AECOM 2009. Lower Passaic River Study Area Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation Document. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA and AECOM, Westford, MA.

Appendix A

WCM/Chemical Data Collection
Field Sampling Plan Addendum
Lower Passaic River Restoration Project

Appendix B

Field Standard Operating Procedures

Appendix C

Laboratory Standard Operating Procedures and Control Limits

To be provided under separate cover.

Appendix C-1

Laboratory Standard Operating Procedures

Appendix C-2

Laboratory Control Limits